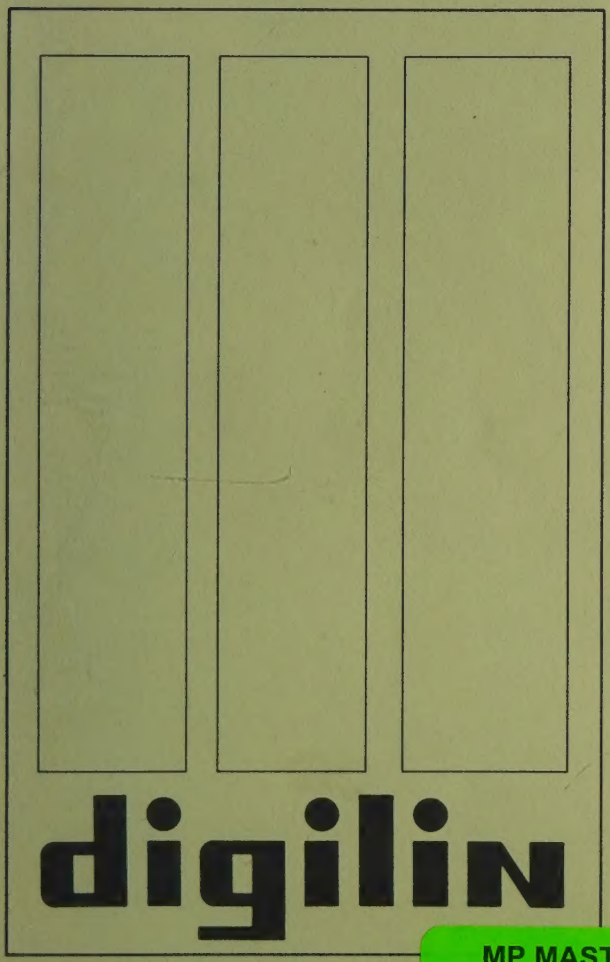
INSTRUCTION MANUAL MODEL 2330



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MP MASTER
MA26186

INSTRUCTION MANUAL

2330 SERIES DIGITAL PANEL METER

INTRODUCTION

The Digilin TYPE 2330 series Digital Panel Meters are general purpose, single range voltmeters designed to provide a digital display of analog information. Through the use of standard available options or custom designed circuitry the meters can be used for an extremely wide variety of control and measurement applications.

The TYPE 2330 features modular construction consisting of three printed circuit assemblies mounted in an extruded aluminum case. Optional features are contained on a fourth circuit board. The die cast aluminum bezel and snap out window allow front panel mounting and calibration while retaining a quality appearance. Parallel binary coded decimal output is provided on all meters. All input and output signals are connected through one of two printed circuit edge card connecters.

The monopolar TYPE 2330 responds to DC voltage inputs of one volt full scale. The bipolar TYPE 2332 contains circuitry which automatically detects the presence of negative input voltages and illuminates the MINUS indicator.

The building block concept utilized in the design of the TYPE 2330 series panel meters allows a wide variety of digital panel meters to be built in a relatively short period of time. Standard option configurations currently available are described in this manual. Since many new options are in process, consult the factory or your local Digilin Representative regarding your requirements. Custom options can be provided by the factory or you can design them yourself.

SPECIFICATIONS*

RANGE, Including 100% Overrange	
TYPE 2330	0 to +1.999 V DC
TYPE 2332 (Autopolarity)	0 to ±1.999 V DC
ACCURACY	
30 days, +20°C to +30°C	±0.1% Reading ±1 digit
90 days, +15°C to +35°C	±0.2% Reading ±1 digit
RESOLUTION	1 mV (1 part in 2000)
BIAS CURRENT (Offset)	1 na maximum
OVERVOLTAGE PROTECTION	±150 Volts peak
INPUT IMPEDANCE	Greater than 1000 megohms
RESPONSE TIME	200 ms typical, 300 ms maximum
NORMAL MODE REJECTION	20 db at 60 Hz (60 db with active filter option)
COMMON MODE REJECTION	Greater than 100 db @ 60 Hz with 1 KΩ unbalance in either input lead
OPERATING TEMPERATURE RANGE	0°C to +50°C
TEMPERATURE STABILITY	±0.009% of reading per °C
READING RATE	4 to 6 readings per second (up to 30 readings per second available)
CONVERSION TIME	10 ms for a maximum reading
WARM-UP TIME	Useable immediately with a maximum of 30 minutes to achieve specified accuracy.

* All specifications apply at +25° Centigrade ambient after 30 minutes warm-up, calibration adjusted to provide a reading of 1000 with an input of +1.000 V DC. Specifications are subject to change without notice.

SPECIFICATIONS (continued)

POWER REQUIREMENTS	115 or 230 V AC 50 to 400 Hz 10 Watts
Weight	31 oz. (875 grams)

OUTLINE AND MOUNTING DIMENSIONS

The TYPE 2330 panel meter may be mounted to a panel of any thickness using four #4-40 Fillister head machine screws. If the clearance holes shown in Figure 1 below (four 0.120 diameter holes) are tapped to accept a #4-40 machine screw thread, mounting may be accomplished entirely from the front panel. Carefully remove the snap-out front panel by inserting a thin blade at the center top of the window and prying it forward. The window will snap out of the tabs securing it at each end. Mounting screws are inserted through the four recessed holes and into the front panel.

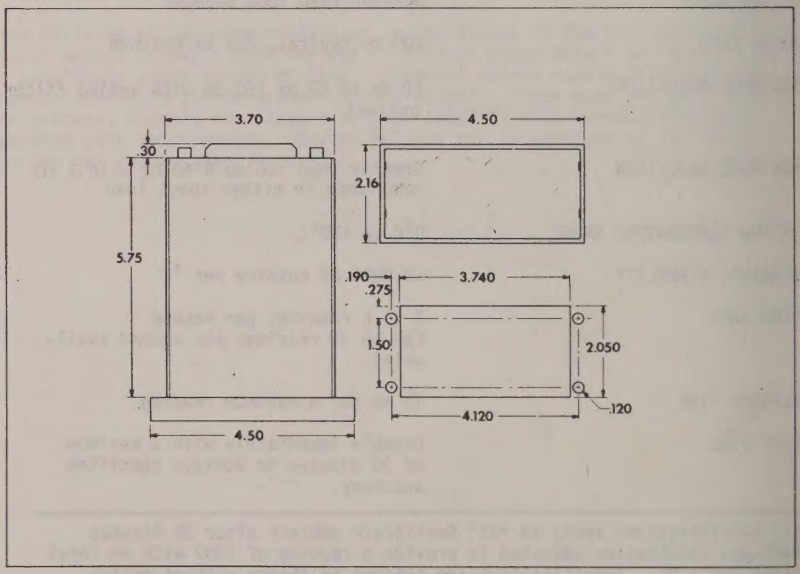


FIGURE 1

THEORY OF OPERATION

The basic TYPE 2330 Digital Panel Meter consists of three functional assemblies: the Power Supply and Time-to-Digital Converter, the Analog-to-Time Converter, and the Digital Display Assemblies. Each is a separate printed circuit assembly. All inter-connections are made by direct plug-in or flexible cable. Optional assemblies are located on a fourth printed circuit assembly. Some inter-connection of optional functions are made internally, however, most are made through the rear panel connectors. This allows maximum utilization of the meter.

POWER SUPPLY AND TIME-TO-DIGITAL CONVERTER

Two separate functions are located on the power supply and time-to-digital converter assembly. One function provides all necessary DC voltages for operating the panel meter and most standard or custom options. The second function is a pulse width to clock pulse converter which drives the counters and display. The assembly and schematic drawings are shown in Figures 3 and 4.

The power supply section is designed to operate on standard 115 or 230 Volts DC, 50 to 400 Hz, line voltage. Operating voltage selection is made by the user at the rear panel connecter J1. The supply consists of three separate secondary windings, each with standard diode rectifiers and resistive-capacitive filters. Emitter-follower regulating transistors Q9 and Q10 operate on the 50 Volts center tapped winding and supply a positive and negative 22 Volts DC respectively. The negative 22 Volt supply is not required on the standard TYPE 2330 and on certain options. A constant current source operating from the +22 Volt output provides approximately 10 ma to a zener diode reference string on the analog-to-time converter assembly. A second low voltage transformer winding supplies +5 Volts DC through emitter-follower regulator Q11. This voltage powers the digital integrated circuits. Power for the display tubes is obtained from the high voltage winding and half-wave rectified.

The pulse output is differentiated and stretched to produce a reset pulse at the beginning of a conversion cycle. Potentiometer R9 is a factory set adjustment to the reset pulse length to compensate for component tolerances. Transistors Q5 and Q6 are gates which control the precision Colpitts oscillator, Q7. The oscillator produces a series of clock pulses at approximately 180 KHz whenever the signal PRINT COMMAND (regenerated by Q2 and Q3) is high. The pulses are counted and decoded to produce the display.

ANALOG-TO-TIME CONVERTER

The Analog-to-Time Converter assembly converts the analog voltage presented to the input into a pulse whose width is proportional to the absolute magnitude of the input voltage. The constant current provided by the power supply assembly is applied to zener string VR1 and VR2 which produce the reference and operating voltages for the circuit. The assembly and schematic diagrams are shown in Figures 5 and 6.

In the monopolar unit, field effect transistors Q1 and Q3 operate as switches connecting the input amplifier to the applied signal or ground controlled by driver Q4.

The constant current source Q8 drives the integrating capacitor C5 which is monitored by amplifier Q6 and Q7. When the magnitude of charge on C5 is equal to the applied input at source-follower Q2 and Q5, the amplifier will cause driver Q4 to saturate. This action reverses the state of the input switches and the bi-stable latch, Q12 and Q13.

Monostable multivibrator, Q10 and Q11, controls the sample rate of the A/D converter. At the end of the monostable period, established by R20 and C7, transistor Q9 is turned on which shunts the current source output and allows C5 to discharge. When the source follower and amplifier determine that the charge has decayed to a "zero" level, driver Q4 turns off which again triggers the switches and the bi-stable latch. The collector of Q13 goes high triggering the monostable and turning off Q9. The integrating capacitor is allowed to charge again. The signal at the collector of Q13 (print command) is also used to drive the bi-stable latch on the power supply assembly either directly or, for isolated versions, through pulse transformer T1.

DIGITAL DISPLAY ASSEMBLY

The Digital Display Assembly consists of three decades of standard series 7400 TTL logic counters and decoder drivers for the gas discharge display tubes. Overrange detection, blanking, and, for bipolar models, polarity detection circuits are also included on the assembly. Assembly and schematic diagrams are shown in Figures 7 and 8.

The serial clock pulses generated on the power supply assembly are counted by decade counters U7, U5, and U3. The overflow of U3 drives half of the dual Jk flip-flop, U1. It's output is used to drive the overrange indicator. Should the count exceed 1999, the second half of U1 causes the three numeric display tubes to blank. The tubes are also blanked during the counting period (PRINT COMMAND) to prevent a "fogged" appearance.

On bipolar models (TYPE 2332) the additional circuitry of Q4, A6, A10 and U8 detect the presence of negative inputs. The polarity signal produces a phase reversal of the analog input switching network and illuminates the minus sign.

Polarity detection is accomplished by comparing the period of monostable multivibrator Q4 and Q6 to the period of print command. A wrong polarity input voltage will cause PRINT COMMAND to decrease in duration. This decrease reverses the state of U8 and the polarity signal supplied to the analog-to-time converter. When the input is reversed the polarity is "correct" and the operation proceeds as described.

AC/OHMS/ACTIVE FILTER/DIVIDER OPTION ASSEMBLY

This option assembly is a multipurpose printed circuit card which can be externally connected to provide a multitude of functions. Space for four separate circuits is located on the assembly: an average responding AC converter, an active filter, a programmable current source and a frequency compensated voltage divider. Only the specified option circuitry is included with a meter. Assembly and schematic diagrams are shown in Figures 9 and 10.

The AC converter is a capacitively coupled differential amplifier with DC feedback. A positive going AC voltage applied through C101 to Q101 produces a positive going voltage at the top of voltage dividers R111 through R113. When the signal goes negative, CR102 becomes forward biased and the voltage appears across R112 and R113 only. By proper selection of the divider ratio, the voltage seen by R110, when properly filtered, becomes the average value of the input. Resistors R107 and R108 establish the proper DC bias point. The rectified AC is fed to the active filter to provide fast response even at low frequencies.

The active filter section is used to provide proper filtering for the AC converter and for other DC voltages as desired. It consists of an AC coupled amplifier connected to provide three poles of filtering. The breakpoints for the poles are determined by R201 and C201, R202 and C202, and R203 and C203. The values supplied in the standard filter are selected to have a breakpoint at approximately 6 Hz which provides 60 db of filtering at 60 Hz.

The ohms current source is used to supply up to 1 milliamp constant current to an external unknown resistance. The source is compensated to eliminate first order temperature drifts over a wide range. Protection against input overloads up to ±150 Volts peak is provided by C301 and R304.

The compensated divider can provide any ratio of AC or DC voltage division desired. Space is provided for frequency compensation as necessary up to approximately 250 KHz.

RATIOMETER OPTION ASSEMBLY

The Ratiometer Assembly is an optional printed circuit board designed to allow measurement of the ratio of two DC voltages. The reference voltage may vary from +200 mV to +2.0 Volts. The ratio of input to reference voltage may vary from 0 to 2.0. To allow a larger range of the reference voltage a resistive divider may be included.

The assembly consists of an operational amplifier for the reference voltage, the output of which is used to drive a variable current source. In operation, the ratiometer current source replaces the compensated current source normally used in the analog-to-time converter.

An active filter may also be provided to use with the signal input if desired. The active filter must not be used at the reference input. Both the reference and input are protected against overloads of up to ±150 Volts peak.

CUSTOM OPTION ASSEMBLY

Custom designed circuitry may be provided and powered by the internal power supply. Internal voltages available for option assembly use are as follows:

+22 V DC at 10 ma
-22 V DC at 10 ma
+ 6 V DC at 1 ma
+12 V DC at 1 ma
- 3 V DC at 1 ma
+ 5 V DC at 50 ma (requires external connection)

All option circuitry must be confined to a single or double-sided circuit card of 1/16 inch epoxy glass material. Dimensions of available space are shown in Figure 2.

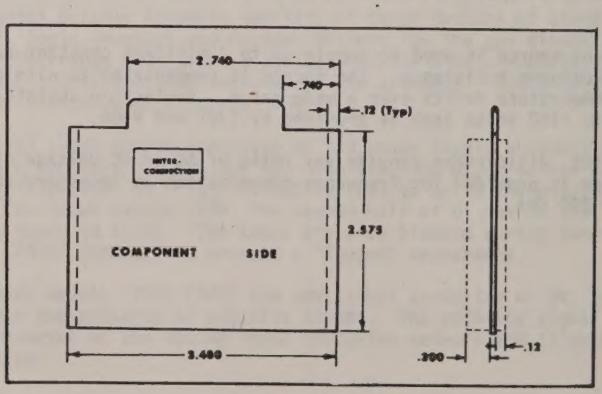


FIGURE 2

NON-LINEAR A/D CONVERTER ASSEMBLY

The non-linear option allows direct display of transducer outputs which are not directly proportional to their input in a linear fashion. The option provides 10 breakpoints for adjusting the slope of A/D conversion during the measurement cycle. This results in a 10 point piecewise linear approximation of the actual input.

For most transducers, the adjustments necessary to linearize the output require a unique design by the factory. The option can also be used with bipolar units providing different conversion slopes in the positive and negative directions.

ISOLATION OPTION

Separate analog and digital grounds may be provided allowing up to ±70 Volts peak differential. The option uses a 1.1 ratio pulse transformer as the interconnection between the analog-to-time converter assembly and the power supply/time-to-digital assembly (T1 on the A/T converter assembly). Since the transformer is on the A/T converter assembly the option can be used with most other available options.

OFFSET OPTION

A positive or negative zero offset can be provided from internal supplies. The offset provides a voltage bias to the LOW input terminal generated by resistive dividers. The option may be used with most available options.

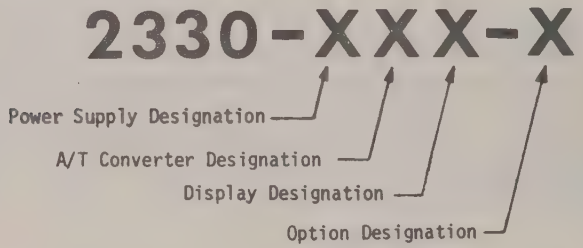
EXTENDED DISPLAY OPTION

The extended display option provides a full scale display of 3999 counts at an input of 2.0 Volts. When the 2.0 Volt input is exceeded, the display will blink four nines. Resolution of the extended display option is increased to 500 microvolts per digit, and accuracy to ±0.05% of reading, ±1 digit.

The extended display is achieved by doubling the integration period of the normal A/T converter. True display storage is added to prevent flicker during conversion. The standard BCD output and hold features are retained for all four digits. The option can be used with most other available options.

OPERATION

The TYPE 2330 Digital Panel Meters are designed to perform an extremely wide variety of measurements with simple operational circuitry. By suitable interconnections at the rear panel the same model may be used in several modes. The wide versatility of the TYPE 2330 meter necessitates a detailed model designation system. A meter is identified by a series of dash numbers indicating the configuration of each of the printed circuit assemblies as follows:



The configurations of each assembly are as follows:

POWER SUPPLY	-3	Positive supply, non-isolated input
	-4	Positive supply, isolated input
	-5	Positive and negative supply, non-isolated input
	-6	Positive and negative supply, isolated input
	-7	Vcc and high voltage only
A/T CONVERTER	-2	Non-isolated, no option connection
	-3	Non-isolated, option connections
	-4	Isolated, no option connection
	-5	Isolated, option connection
	-7	Ratiometer, non-isolated
	-8	Ratiometer, isolated
	-9	Power connections only
DISPLAY ASS'Y	-1	3½ digit, no polarity detector
	-2	3½ digit, bipolar detector
	-3	3½ digit wrong polarity

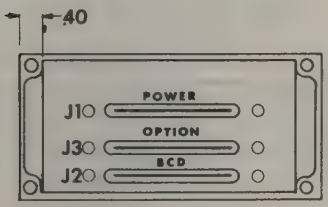
Option Assembly

-1	Ohms Current source
-2	Active filter (60 db @ 60 Hz)
-3	Active filter and ohms
-4	AC converter and active filter
-5	AC converter, active filter and ohms
-6	Ratiometer
-7	Ratiometer and active filter
-8	Ratiometer and 10:1 divider
-9	Ratiometer, active filter and 10:1 divider
-10	AC, active filter, 100:1 divider

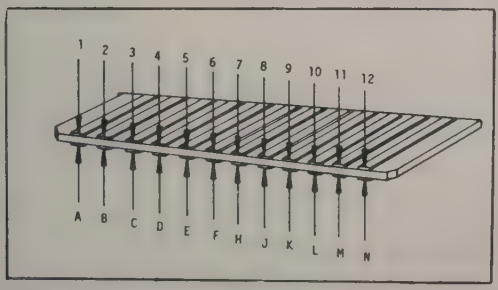
CAUTION

Improper connection of the input signals or inadvertent reversal of the connectors may result in extensive permanent damage to the meter which is not covered by the warranty. Before applying power, make absolutely certain that all connections are correct.

All input and output connections are made to the dual, 12 position edge card connectors at the rear of the meter. Connector designations are as follows:



J1			J2	
1 VAC	A VAC		1 4	A 8
2 VAC	B VAC		2 2	B 40
3 POLARITY	C SHIELD		3 1	C 20
4	D SPARE		4 RESET (tp)	D 400
5 +12V (tp)	E SPARE		5 SPARE	E 200
6 −3V (tp)	F SPARE		6 10	F HOLD
7 XX.X	H +6V (tp)		7 80	H VCC (tp)
8 X.XX	J FILTER OUT		8 100	J GND
9 .XXX	K SPARE		9 800	K CLOCK (tp)
10 FILTER GND	L HIGH		10 PRT COMD	L SPARE
11 FILTER IN	M SPARE		11 OUT RANGE	M BLANK
12 ANALOG GND	N LOW		12 +200V (tp)	N 1000



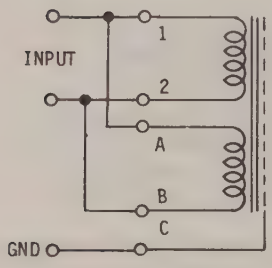
IC HIGH = A+1 HIGH = L
C LOW = B+2 LOW = N
RD(AC) = 3

POWER CONNECTIONS

The TYPE 2330 panel meters are designed to operate from 115 or 230 Volts AC, 50 to 400 Hz. Power connections are made at connector J1 as follows:

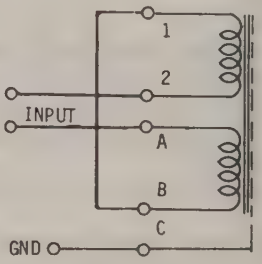
115 Volt Operation:

Connect "1" to "A" and "2" to "B". Apply power to terminals "1" and "2".



230 Volt Operation:

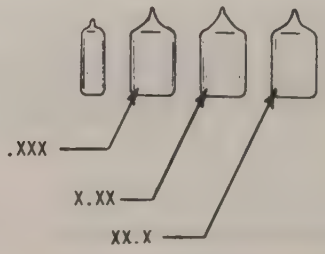
Connect "1" to "B". Apply power to "2" and "A"



DECIMAL POINTS

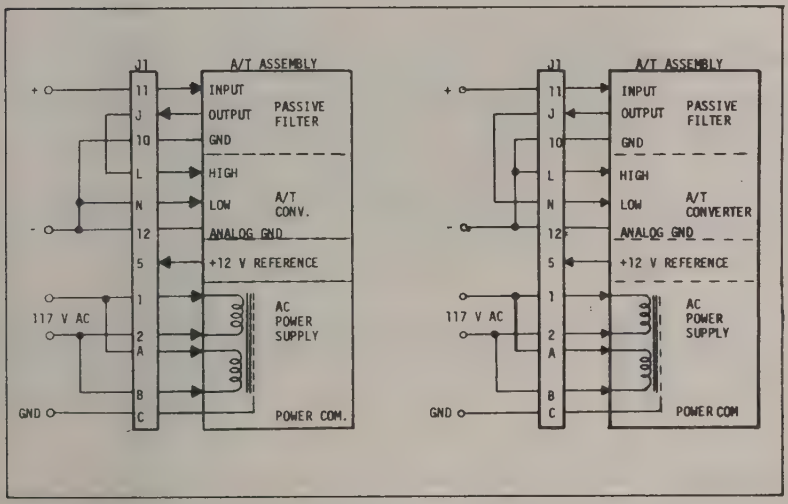
All TYPE 2330 panel meters are provided with three programmable decimal points. The selected decimal point is programmed by connecting the appropriate terminal to ground. In isolated input options, the decimal points must be connected to the digital ground (J2-J) rather than analog ground (J1-12). In all other versions the decimal points may be connected to either analog or digital ground.

The decimal points are designated as follows:



VOLTAGE MEASUREMENTS

The TYPE 2330 series panel meters are designated to perform a variety of functions with one standard meter. This increased versatility has necessitated an increase in complexity of the connections to the meter. The basic connections for DC voltages are shown below:



The single-pole passive filter normally provides sufficient normal mode rejection for most applications. If additional filtering is required, the 3-pole active filter option should be used. Connections for use of the active filter are shown on page 14.

Whenever voltages in excess of the 1 Volt full scale are to be measured, a resistive voltage divider should be used. Space is available on the option assembly for a divider of any desired ratio. The divider may also be located on the input connector. Since the input impedance of the meter is directly affected by the divider, the values chosen should be selected with care. In most applications, the calibration range of the meter will be sufficient to allow use of non-precision divider resistors.

MINUS SIGN

In monopolar instruments a "minus" sign is provided for optional use. The "minus" sign is illuminated by connecting the rear panel POLARITY signal to digital ground (J2-J). Again, in non-isolated versions, POLARITY may be connected to analog GND (J1-12).

In bipolar instruments the "minus" sign is automatically illuminated whenever the high input terminal is of lower absolute potential than the low input terminal.

CURRENT MEASUREMENTS

Current measurements are accomplished by using a shunt resistance to develop a voltage at the meter input. The resistance value selected should be sufficient to produce a voltage drop equal to the full scale voltage range of the meter when the desired full scale current is measured.

The following values are recommended for shunt resistors for 1 Volt full scale meters:

RANGE	RESISTANCE
100 µA	10 K Ω ½ Watt
1 MA	1 K Ω ½ Watt
10 MA	100 Ω ½ Watt
100 MA	10 Ω ½ Watt
1 AMP	1 Ω 2 Watt
10 AMP	.1 Ω 25 Watt

BCD OUTPUT

Positive true TTL compatible BCD output is provided as a standard feature. The BCD output will sink up to 8 milliamps at logical "0". The output is referenced to the digital ground. Logic levels are defined as follows:

Logic "1"	+2.4 Volts or more
Logic "0"	+0.8 Volts or less

The display and BCD output may be held constant by activating the HOLD input. The terminal is activated by applying a logical 1 to J2-F (referenced to digital ground). When activated, the hold function prevents update of the BCD and display information. If hold is activated during a conversion period, the effect is delayed until conversion is complete. A conversion period is signified by PRINT COMMAND signal (J2-10) assuming a logical "1" state. The BCD information should be considered valid only when PRINT COMMAND is at logical "0".

The BCD output terminal designations are shown on Page 10.

STANDARD OPTIONS

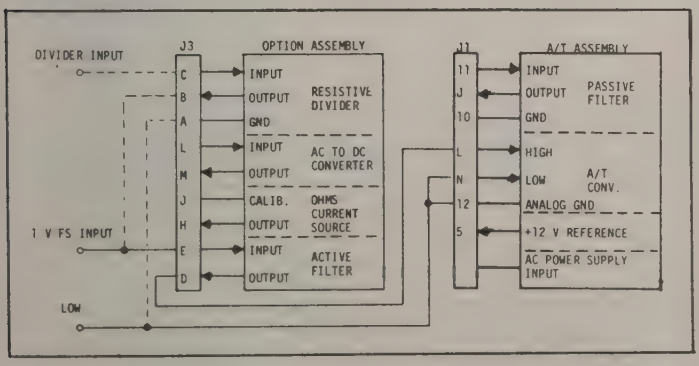
The following are the instructions for the standard options on the 2330 series panel meters. The fact that an option is contained in the panel meter does not restrict the use of the panel meter to that of the option only. It still contains the basic DC meter. Since the options are programmable, with appropriate switching, it may be used as a multipurpose meter.

Connections for the available options are shown below. Specific instructions are provided for each option. It should be noted that only the option circuitry specified by the model designation is included in any individual meter.

ACTIVE FILTER

The 3-pole active filter provides 60 db of normal mode noise rejection at 60 Hz for any DC input. The option replaces the passive filter normally used. The HIGH input to the active filter is located on option connector J3, pin "E". The output, J3-D, is connected to the A/T converter HIGH input pin J1-L. The LOW input is located on J1-N.

Connections for positive DC voltage measurements using the active filter are shown below. For negative voltage measurements, connect the filter output (J3-D) to the A/T LOW input (J1-N) and the A/T HIGH input (J1-L) to analog ground (J1-12).



OHMS MEASUREMENT

The ohms-measuring circuit consists of a programmable constant current source, and may be supplied either with or without the active filter option. The magnitude of the current is equal to the full scale range divided into 1 Volt. For example, in the 1 K ohm range, the constant current equals 1 milliamp.

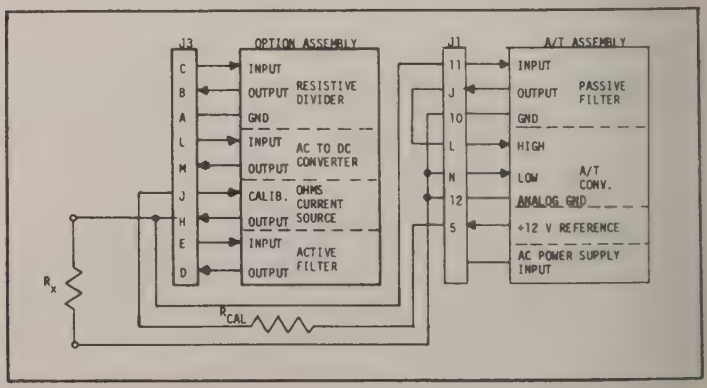
A programming resistor is connected between +12 Volts and terminals on option connecter J3, OHMS CAL. The value of this resistor determines the value of the constant current. Typical suggested values are as follows:

RANGE	PROGRAMMING RESISTOR
1 K Ω	5.1 K
10 K Ω	51.0 K
100 K Ω	510.0 K
1 M Ω	5.1 M

Resistance tolerances and/or calibration adjustment may require values slightly different from above. These values are provided only as a guide.

The resistance to be measured is connected across the input to the active or passive filter. The output of the filter is connected to the input of the A/T converter. The constant current source is then connected to the unknown resistance.

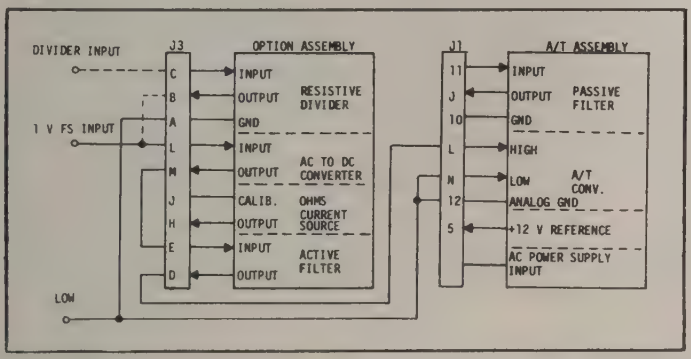
The open circuit voltage of the constant current source is less than 10 Volts DC.



AC CONVERTER

The AC Converter option consists of an average-responding AC to DC converter connected to the 3 pole active filter. The full scale range is 1 Volt RMS, with overrange capability to 2 Volts RMS. External connections must be made between the AC converter, and the 3 pole active filter, and the A/T converter. This will allow the use of the meter for measuring either AC or DC voltages.

Connections are made as shown below:



By adding the resistance divider option the AC meter may serve as a line voltage monitor. For high frequency applications, the divider may be frequency-compensated to over 100 KHz.

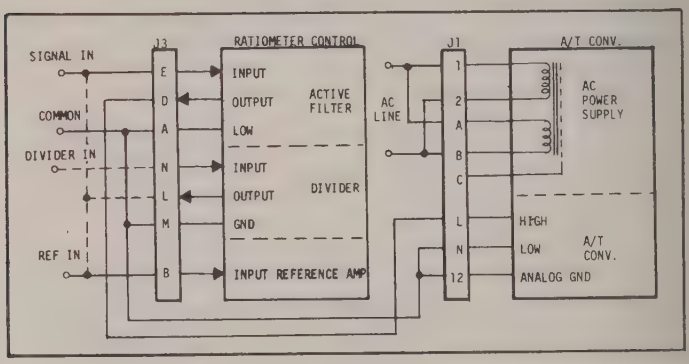
RATIOMETER

The ratiometer option allows direct comparison of two DC voltages over a ten-to-one change of the reference voltage. The 3-pole active filter may be used at the signal input to provide 60 db normal mode range rejection at 60 Hz.

C A U T I O N

Do not operate the meter with the 3 pole active filter connected to the reference voltage input. The larger bias currents produced by the reference voltage amplifier will produce a calibration shift.

A reference voltage of +0.20 to +2.00 Volts DC is connected to J3-B. The input signal is connected to J1-L. Both voltages are referenced to J1-12. The display will then indicate the ratio of the signal input to the reference input. Complete connections are as follows:



ISOLATION

Separate analog and digital grounds are provided by the isolation option. The option may be used together with any other option assembly. No changes are necessary to input connections.

OFFSET

The analog to digital converter "zero point" may be offset up to ±200 counts by applying an internally generated DC bias voltage. The voltage is adjustable continuously throughout the range.

WRONG POLARITY

The Wrong Polarity option is used on monopolar instruments to indicate an improper connection of the input. The option will blank the display and light the minus indicator. This option is available only with monopolar instruments.

CALIBRATION

Calibration of the TYPE 2330 Digital Panel Meter is accomplished by adjustment of the full scale potentiometer located behind the snap-out plastic lens. All calibration adjustments should be made only after the meter has had a minimum of 30 minutes for warm-up.

BASIC DC METER

Calibration of the basic meter is accomplished as follows:

1. Apply +1.000 Volt DC to the input HIGH and LOW terminals. The voltage should be supplied from a voltage calibrator or other source known to have an absolute accuracy of ±0.02% or better.

2. Using a small screwdriver adjust the full scale vernier potentiometer adjustment for a display of exactly 1000.

3. This completes full scale adjustment.

> NOTE: When external dividers or current shunts are used, the desired full scale voltage or current should be substituted in Step 1 above.

A reset length adjustment (located on the T/D converter board) effectively adds or subtracts a few digits to the displayed voltages. This can be used to compensate for small ground currents or thermal effects. Under normal circumstances, it is factory-set and should not require adjustment. If adjustment is required, perform the following steps:

1. Remove the meter from its case.

2. Apply power to the meter and allow a minimum of 30 minutes for warm-up.

3. Apply a +10 millivolt signal between the HIGH and LOW input terminals.

4. Adjust the reset-length potentiometer (R9) until a display of exactly 010 is achieved.

5. This completes the reset length adjustment. Reassemble the meter and perform the calibration sequence above.

AC OPTION

Calibration of the AC option assembly is accomplished as follows:

1. Disassemble the meter by removing the four screws holding the top rear panel in place.

2. Carefully slide the four printed circuit boards out of the case.

3. Perform the basic DC meter calibration above.

4. Apply a known 1.000 VRMS to the AC converter input and adjust R113 on the option assembly to provide an indication of 1.000. Provision for optional high frequency compensation has been made. Please consult the factory for details.

5. Reassemble the meter using care to assure that the adjustments made are not disturbed.

OHMS

The ohms calibration may be accomplished externally by adjustment of the range-programming resistor or by internal adjustment of R302 on the option assembly. Proceed as with the AC converter above.

RATIOMETER

A separate reference and signal input source is required to calibrate the ratiometer. Adjustments are made as follows:

1. Connect the reference and signal input lines together.

2. Apply +1.000 Volt DC on the signal and reference lines. Adjust R104 on the option assembly to read 1000.

3. Apply +0.200 Volt DC on the signal and reference lines. Adjust R111 on the option assembly to read 1000.

4. Repeat Step 2.

5. Repeat Step 3.

6. Connect separate sources to the signal and reference inputs.

7. With the reference at +1.0 Volt DC, vary the input signal from 0 to 2 Volts to check linearity.

8. With reference at +0.2 Volt DC, vary the input signal from 0 to +0.400 to check linearity.

9. With reference at +2.0 Volts DC, vary signal from 0 to 2 Volts to check linearity.

10. If the linearity checks in steps 7, 8, or 9 do not indicate proper operation, repeat steps 2 and 3 again.

11. This completes the ratiometer calibration.

TROUBLE-SHOOTING

Digilin Digital Panel Meters, while small in size, are quite complex in operation. The analog-to-digital converter module is a precisely adjusted network designed to provide maximum trouble-free use.

When difficulty is encountered with the operation of the panel meter, perform the following operational checks:

1. Verify that input power is correctly applied to the meter.

2. Verify that the input is of the proper magnitude and polarity and that it is properly connected.

3. Verify the assembly inter-connections are properly aligned and inserted on the P.C. assemblies.

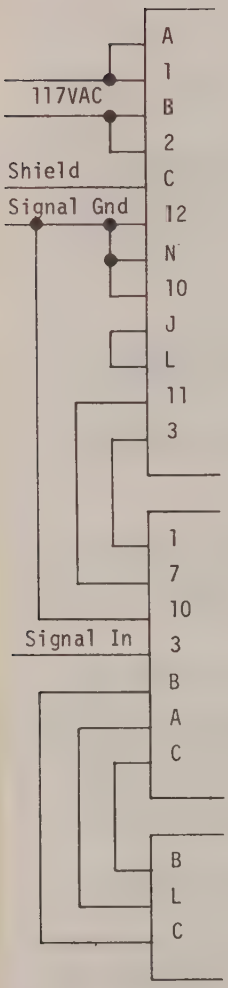
4. Verify that all other connections for decimal points, BCD output, etc. are properly made.

5. Using any oscilloscope verify that the signal PRINT COMMAND is present on J2-10 as a pulse whose width is proportional to the input voltage. PRINT COMMAND should be about 5 ms duration at 1 Volt input and is referenced to digital ground. Verify that the RESET pulse occurs at the beginning of the PRINT COMMAND signal and the CLOCK pulses are present during the print COMMAND SIGNAL.

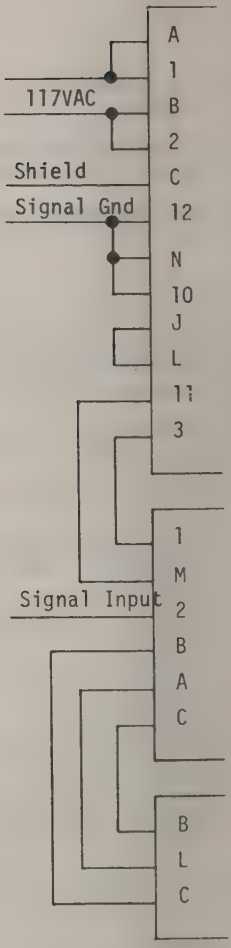
6. Check all power supply voltages to verify proper operation of the supply. The voltages are available at the rear panel connecters.

7. Disassemble the meter by removing the top-rear panel and carefully sliding the printed circuit assemblies out of the case. All assemblies must be removed together to prevent damage.

8. Using the assembly and schematic drawings and the theory of operation contained in this manual, isolate the fault to a printed circuit assembly. The defective assembly may be repaired or returned to the factory for service.



2432E-534-01
2432G-534-01
2432H-534-01
2432G-537-01
2432H-537-01
2432J-537-01
2432E-539-01
2432G-539-01
2432H-539-01



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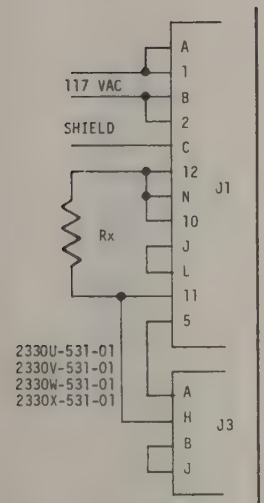
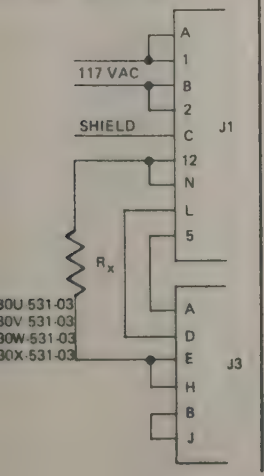
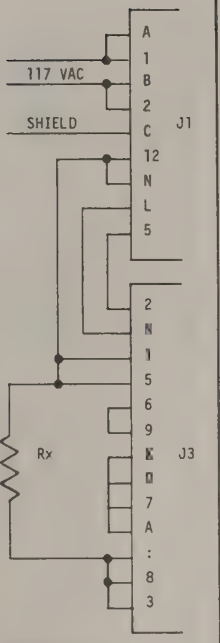
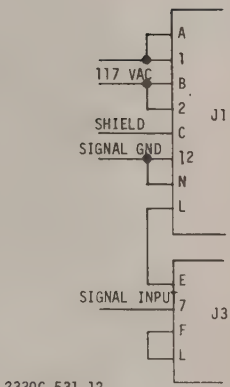
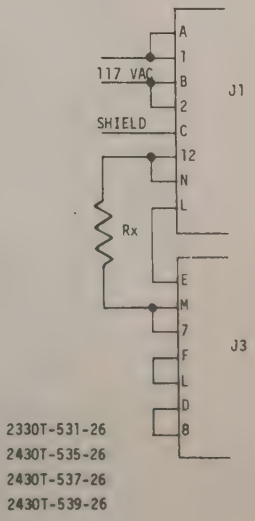
2432C-537-03
2432C-539-03

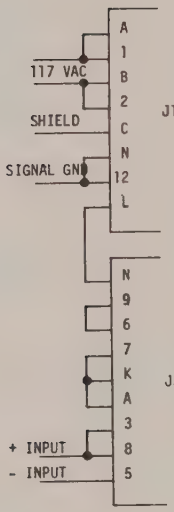

117 VAC
SHIELD
Rx
J1
J3
2330U-531-01
2330V-531-01
2330W-531-01
2330X-531-01


117 VAC
SHIELD
Rx
J1
J3

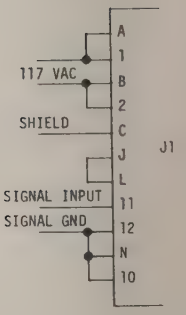

117 VAC
SHIELD
Rx
J1
J3
2330R-531-24
2330S-531-25
2430R-535-24
2430S-535-25
2430R-537-24
2430S-537-25
2430R-539-24
2430S-539-24


117 VAC
SHIELD
SIGNAL GND
SIGNAL INPUT
J1
J3
2330C-531-12
2332C-532-12
2430C-535-12
2430C-537-12
2430C-539-12


117 VAC
SHIELD
Rx
J1
J3
2330T-531-26
2430T-535-26
2430T-537-26
2430T-539-26



2330A-531-20
2330B-531-21
2332A-532-20
2332B-532-21
2430A-535-20
2430B-535-21
2430A-537-20
2430B-537-21
2430A-539-20
2430B-539-21



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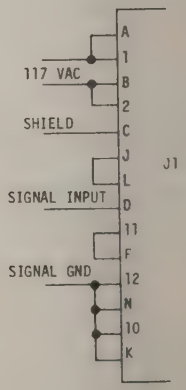
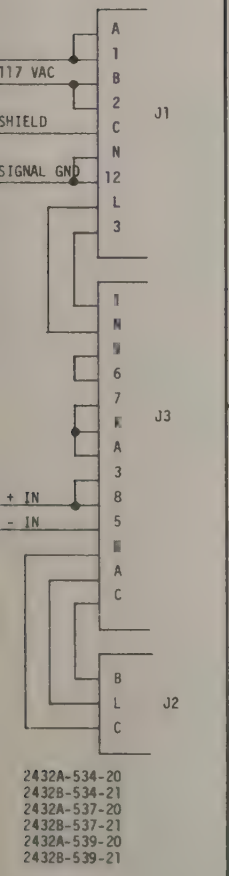
2332E-532-0
2430D-535-0
2430D-537-0
2430D-539-0



2330G-531-0
2330H-531-0
2330J-531-0
2332G-532-0
2332H-532-0
2332J-532-0
2430E-535-0
2430G-535-0
2430H-535-0
2430E-537-0
2430G-537-0
2430H-537-02430E-539-0
2430G-539-0
2430H-539-0



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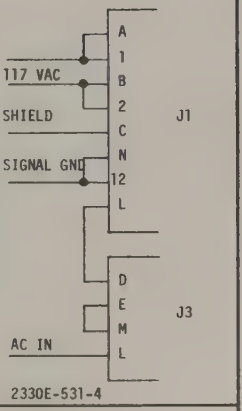
2432B-534-21
2432A-537-20
2432B-537-21
2432A-539-20
2432B-539-21



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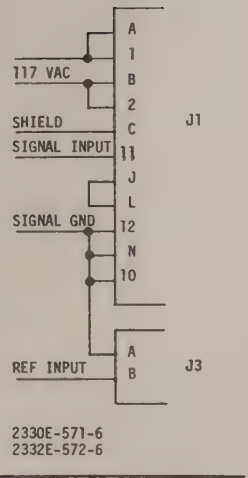

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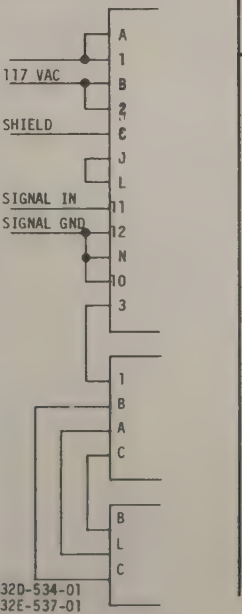
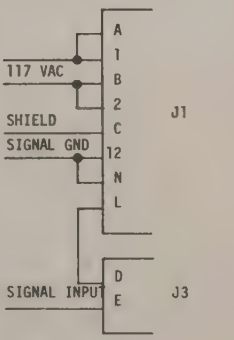
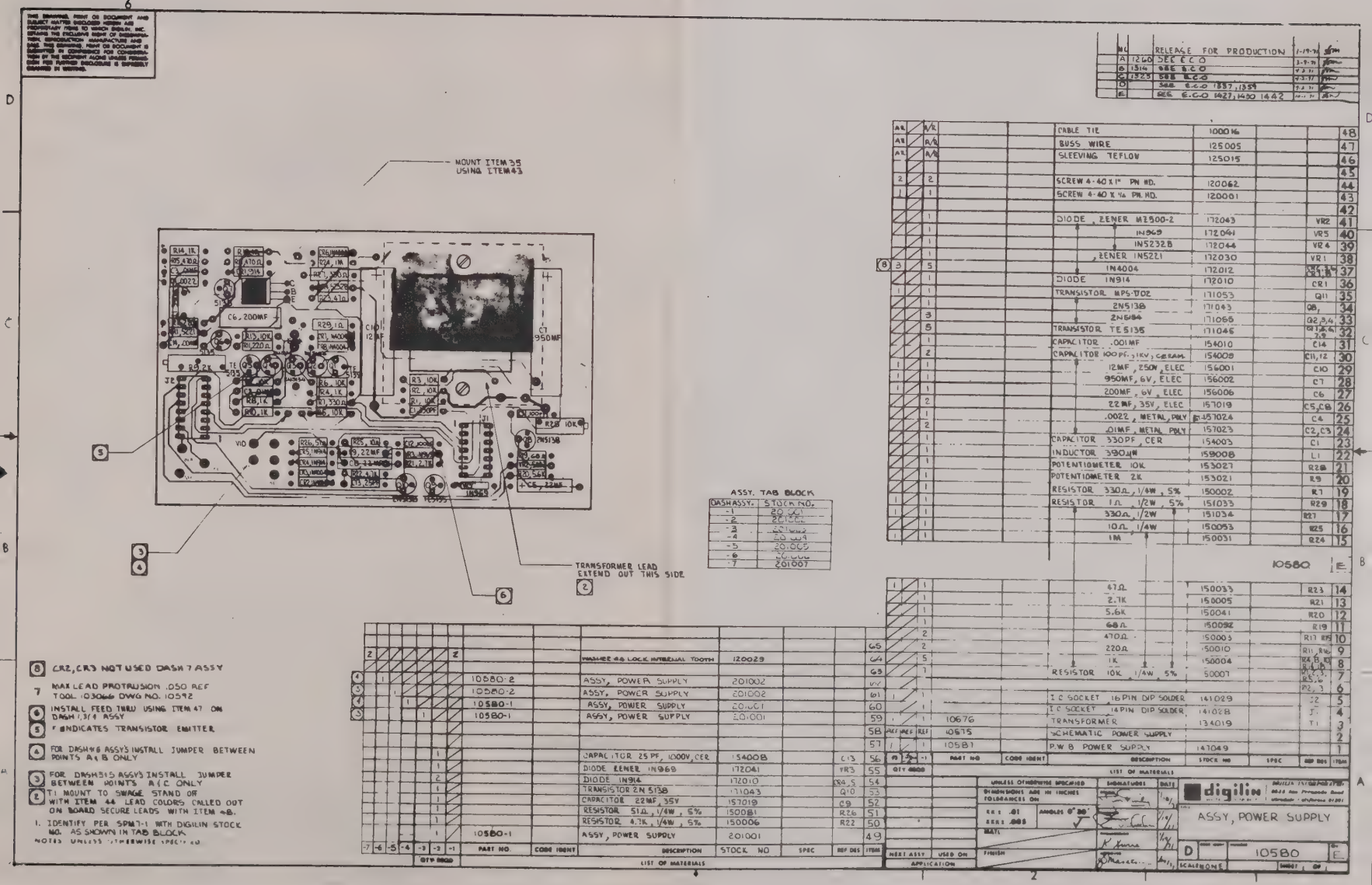
2332E-572-6



2432D-534-01
2432E-537-01



2330E-531-02
2332E-532-02



8 CR2, CR3 NOT USED DASH 7 ASSY

7 MAX LEAD PROTRUSION .050 REF TOOL 103066 DWG NO. 10592

6 INSTALL FEED THRU USING ITEM 47 ON DASH 1, 3, 4 ASSY

5 * INDICATES TRANSISTOR EMITTER

4 FOR DASH #8 ASSYS INSTALL JUMPER BETWEEN POINTS A & B ONLY

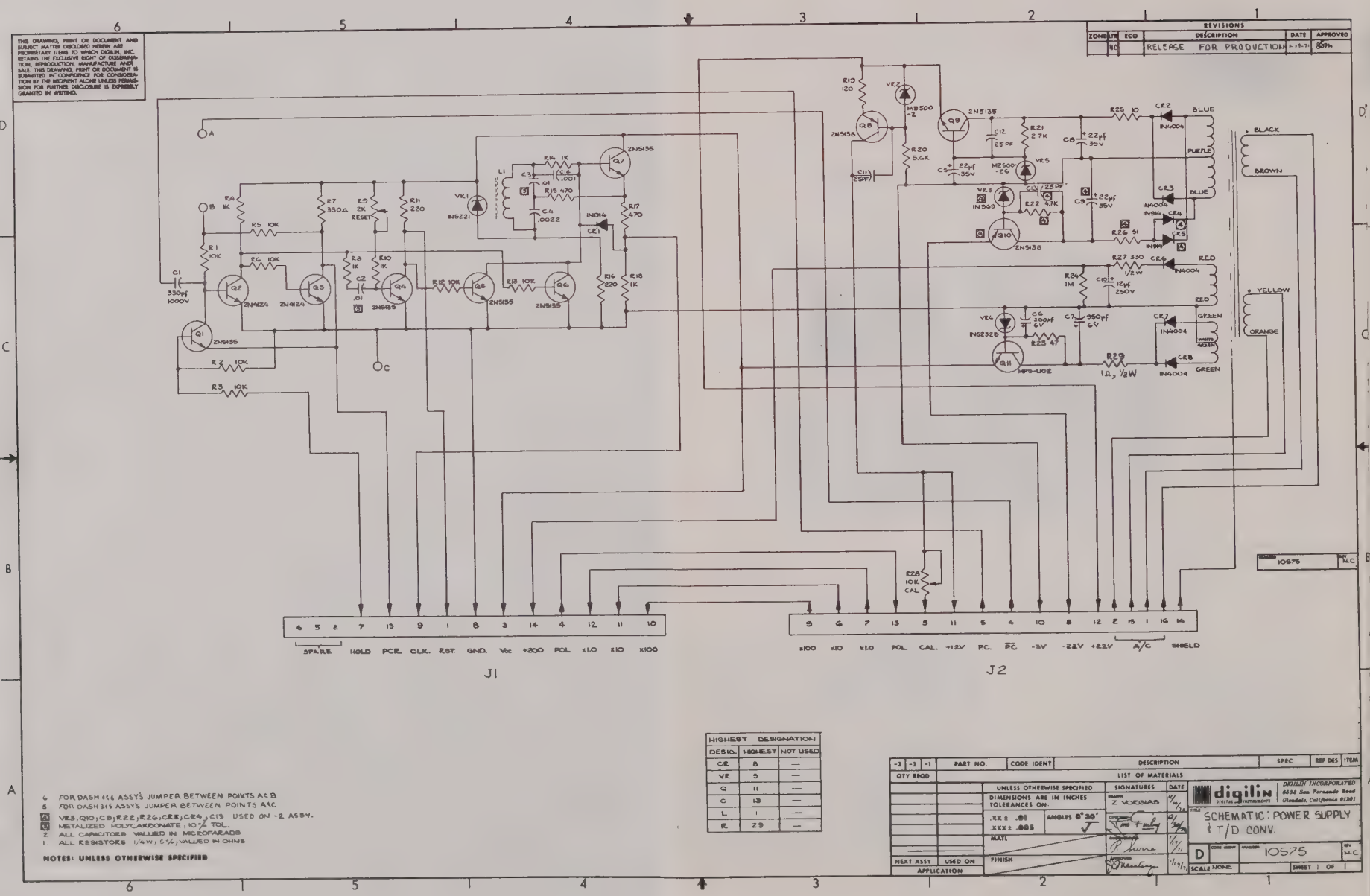
3 FOR DASH #3 & 5 ASSYS INSTALL JUMPER BETWEEN POINTS A & C ONLY

2 T1 MOUNT TO SWAGE STAND OR WITH ITEM 44 LEAD COLORS CALLED OUT ON BOARD SECURE LEADS WITH ITEM 48.

1. IDENTIFY PER SPM7-1 WITH DIGILIN STOCK NO. AS SHOWN IN TAB BLOCK

NOTES: UNLESS OTHERWISE SPECIFIED

Figure 3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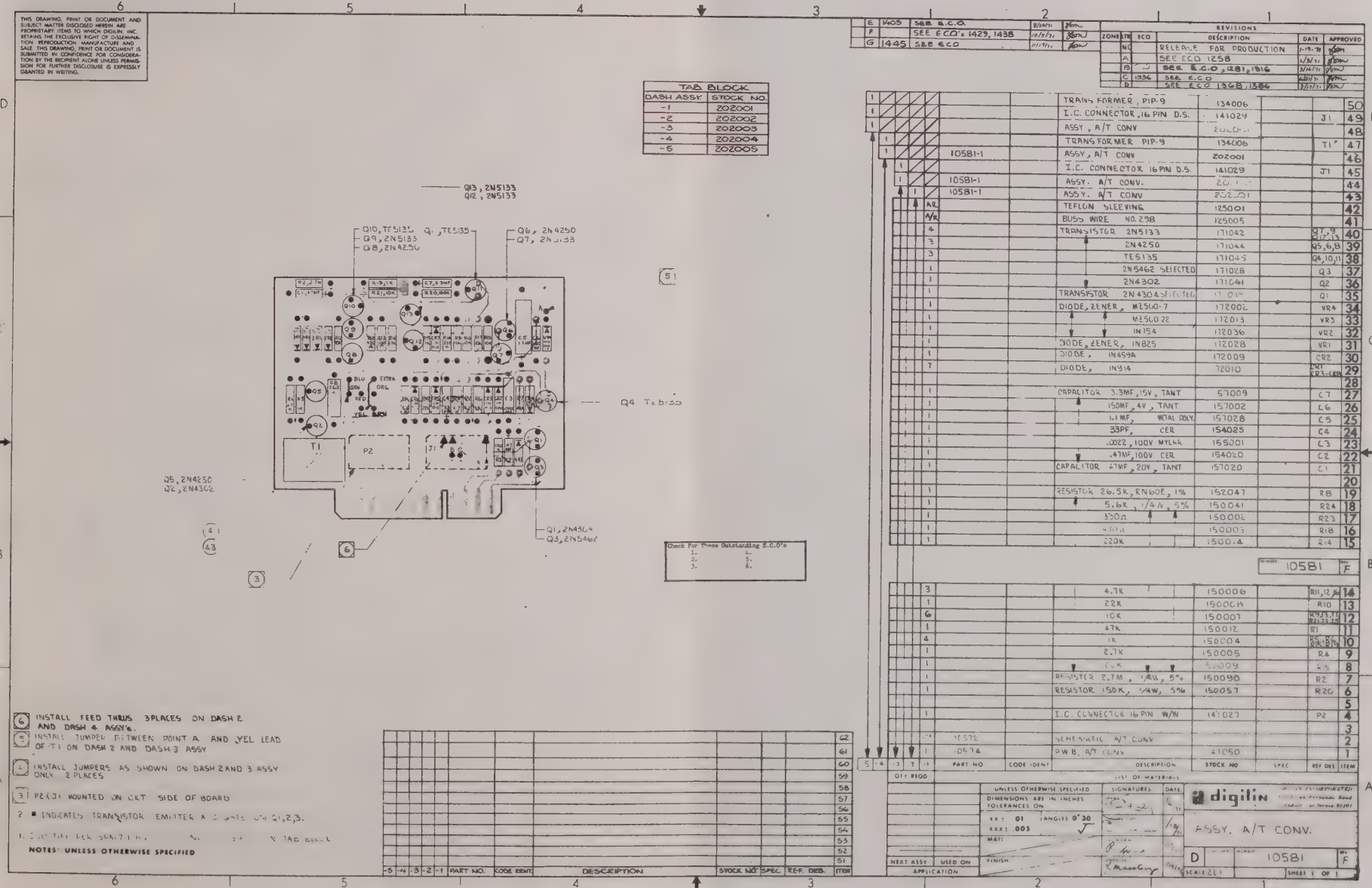
REVISIONS
ZONE/LTR ECO DESCRIPTION DATE APPROVED
NC RELEASE FOR PRODUCTION 1-19-71 DGH
J1
SPARE HOLD PCR CLK RST GND Vcc +200 POL x1.0 x10 x100
J2
x100 x10 x1.0 POL CAL +12V PC PC -3V -22V +22V A/C SHIELD
HIGHEST DESIGNATION
DESIG. HIGHEST NOT USED
CR 8 —
VR 5 —
Q 11 —
C 13 —
L 1 —
R 29 —
6 FOR DASH #6 ASSY'S JUMPER BETWEEN POINTS A & B
5 FOR DASH #5 ASSY'S JUMPER BETWEEN POINTS A & C
A VR3, Q10, C9, R22, R26, CR5, CR4, C13 USED ON -2 ASSY.
G METALIZED POLYCARBONATE, 10% TOL.
2 ALL CAPACITORS VALUED IN MICROFARADS
1. ALL RESISTORS 1/4W, 5% VALUED IN OHMS
NOTES: UNLESS OTHERWISE SPECIFIED
-3 -2 -1 PART NO. CODE IDENT DESCRIPTION SPEC REF DES ITEM
QTY REQD
LIST OF MATERIALS
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON:
.XX ± .01 ANGLES 0° 30'
.XXX ± .005
MATL
FINISH
NEXT ASSY USED ON
APPLICATION
SIGNATURES DATE
Z VOEGLAS 1/20/71
1/21/71
1/21/71
DRAWN
CHECKED
ENGR APPR
MFG APPR
digilin DIGITAL INSTRUMENTS
DIGILIN INCORPORATED
6638 San Fernando Road
Glendale, California 91201
TITLE SCHEMATIC: POWER SUPPLY & T/D CONV.
SIZE D CODE IDENT 10575 REV W.C.
SCALE NONE SHEET 1 OF 1

Figure 4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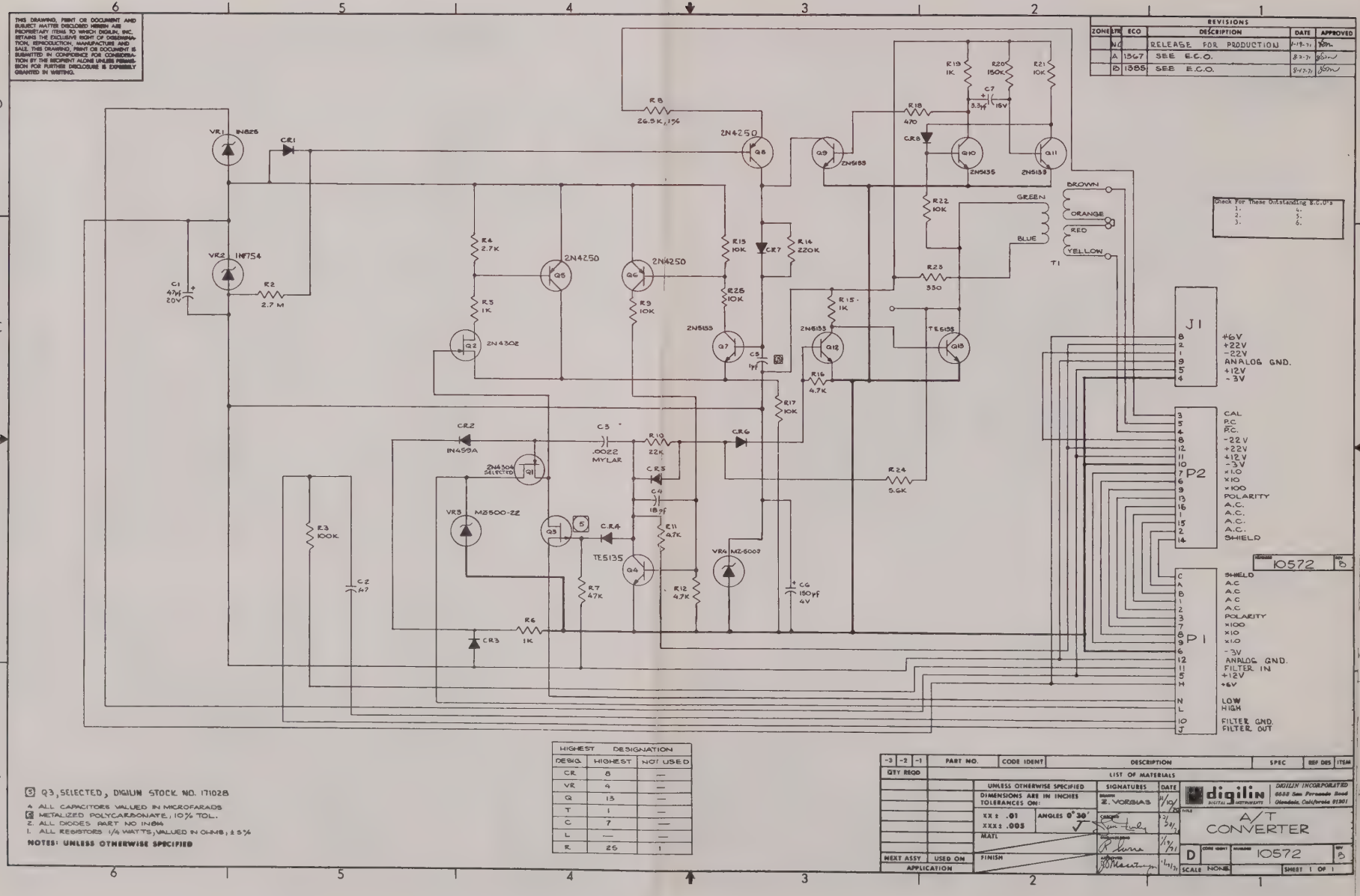
TAB BLOCK
DASH ASSY. STOCK NO.
-1 202001
-2 202002
-3 202003
-4 202004
-5 202005
Q3, 2N5133
Q12, 2N5133
Q10, TES135
Q9, 2N5133
Q8, 2N4250
Q6, 2N4250
Q7, 2N4338
Q4, TES135
Q5, 2N4250
Q2, 2N4302
Q1, 2N4304
Q3, 2N5462
Check For These Outstanding E.C.O's
REVISIONS
ZONE LTR ECO DESCRIPTION DATE APPROVED
NC RELEASE FOR PRODUCTION
A SEE ECO 1258
B SEE E.C.O. 1281, 1316
C SEE E.C.O
D SEE ECO 1368, 1386
TRANSFORMER, PIP-9 134006
I.C. CONNECTOR, 16 PIN D.S. 141024 J1
ASSY, A/T CONV
TRANSFORMER PIP-9 134006 T1
10581-1 ASSY, A/T CONV 202001
I.C. CONNECTOR 16 PIN D.S. 141029 J1
10581-1 ASSY. A/T CONV.
10581-1 ASSY. A/T CONV
TEFLON SLEEVING 125001
BUSS WIRE NO. 28B 125005
TRANSISTOR 2N5133 171042 Q7,9,12,13
2N4250 171044 Q5,6,8
TES135 171045 Q4,10,11
2N5462 SELECTED 171028 Q3
2N4302 171041 Q2
TRANSISTOR 2N4304 SELECTED Q1
DIODE, ZENER, M2S00-7 172002 VR4
M2S0022 172013 VR3
IN154 172036 VR2
DIODE, ZENER, IN825 172028 VR1
DIODE, IN459A 172009 CR2
DIODE, IN914 72010 CR1-CR3
CAPACITOR 3.3NF, 15V, TANT 57009 C7
150MF, 4V, TANT 157002 C6
.1MF, METAL POLY 151028 C5
33PF, CER 154025 C4
.0022, 100V MYLAR 155001 C3
.47NF, 100V CER 154020 C2
CAPACITOR 47MF, 20V, TANT 157020 C1
RESISTOR 26.5K, RN60E, 1% 152047 R8
5.6K, 1/4W, 5% 150041 R24
330Ω 150002 R23
220K 150004 R14
10581 F
4.7K 150006 R11,12
22K 150006 R10
10K 150007 R9,13,15,16,R21,22,27
4.7K 150012 R7
1K 150004 R3,R5,R6,R17,R18,R19,R20
2.7K 150005 R4
CUK 5000 R5
RESISTOR 2.7M, 1/4W, 5% 150090 R2
RESISTOR 150K, 1/4W, 5% 150057 R26
I.C. CONNECTOR 16 PIN W/W 141027 P2
10572 SCHEMATIC A/T CONV
.0574 P.W.B. A/T CONV 41050
PART NO CODE IDENT DESCRIPTION STOCK NO SPEC REF DES ITEM
QTY REQD
LIST OF MATERIALS
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
XX: .01 ANGLES 0°30'
XXX: .005
MAT'L
FINISH
SIGNATURES DATE
NEXT ASSY USED ON
APPLICATION
digilin
ASSY. A/T CONV.
D 10581 F
SCALE 2/1 SHEET 1 OF 1
6 INSTALL FEED THRUS 3PLACES ON DASH 2 AND DASH 4 ASSY's.
5 INSTALL JUMPER BETWEEN POINT A AND YEL LEAD OF T1 ON DASH 2 AND DASH 3 ASSY
4 INSTALL JUMPERS AS SHOWN ON DASH 2 AND 3 ASSY ONLY 2 PLACES
3 P2 & J1 MOUNTED ON CRT SIDE OF BOARD
2 ● INDICATES TRANSISTOR EMITTER A
1. DO NOT USE SOLDER IN
NOTES: UNLESS OTHERWISE SPECIFIED
PART NO. CODE IDENT. DESCRIPTION STOCK NO. SPEC. REF. DES. ITEM

Figure 5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REVISIONS
ZONE | LTR | ECO | DESCRIPTION | DATE | APPROVED
N.C. | RELEASE FOR PRODUCTION | 4-19-71 | JSM
A | 1367 | SEE E.C.O. | 8-2-71 | JSM
B | 1385 | SEE E.C.O. | 8-17-71 | JSM
Check For These Outstanding E.C.O.'s
1. 4.
2. 5.
3. 6.
VR1 IN825
CR1
VR2 IN754
C1 47µf 20V
R2 2.7 M
R4 2.7K
R3 1K
Q2 2N4302
Q5 2N4250
Q6 2N4250
R8 26.5K, 1%
Q8 2N4250
R9 10K
R15 10K
CR7
R14 220K
R25 10K
Q7 2N5133
C5 1pf
Q9 2N5133
R13 1K
R20 150K
R21 10K
C7 3.3µf 15V
R18 470
CR8
Q10 2N5435
Q11 2N5133
R22 10K
R23 330
T1
BROWN
ORANGE
RED
YELLOW
GREEN
BLUE
R15 1K
Q12 2N5133
Q13 TE6135
R16 4.7K
R17 10K
R24 5.6K
J1
+6V
+22V
-22V
ANALOG GND.
+12V
-3V
P2
CAL
P.C.
P.C.
-22 V
+22V
+12 V
-3V
x1.0
x10
x100
POLARITY
A.C.
A.C.
A.C.
A.C.
SHIELD
10572 B
P1
SHIELD
A.C
A.C
A.C
A.C
POLARITY
x100
x10
x1.0
-3V
ANALOG GND.
FILTER IN
+12V
+6V
LOW
HIGH
FILTER GND.
FILTER OUT
CR2 IN459A
C3 .0022 MYLAR
R10 22K
CR5
C4 18pf
2N4304 SELECTED
Q11
VR3 MZ500-22
Q3
5
CR4
E11 4.7K
TE5135
Q4
VR4 MZ-5003
C6 150pf 4V
R12 4.7K
R7 47K
R6 1K
CR3
E3 100K
C2 .47
HIGHEST DESIGNATION
DESIG. | HIGHEST | NOT USED
CR. | 8 | —
VR. | 4 | —
Q. | 13 | —
T. | 1 | —
C. | 7 | —
L. | — | —
R. | 25 | 1
5 Q3, SELECTED, DIGILIN STOCK NO. 171028
4 ALL CAPACITORS VALUED IN MICROFARADS
4 METALIZED POLYCARBONATE, 10% TOL.
2. ALL DIODES PART NO IN814
1. ALL RESISTORS 1/4 WATTS, VALUED IN OHMS, ±5%
NOTES: UNLESS OTHERWISE SPECIFIED
-3 -2 -1 | PART NO. | CODE IDENT | DESCRIPTION | SPEC | REF DES | ITEM
QTY REQD
LIST OF MATERIALS
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON:
XX ± .01
XXX ± .005
ANGLES 0° 30'
MATL
FINISH
NEXT ASSY | USED ON
APPLICATION
SIGNATURES | DATE
DRAWN Z. VORSHAS 3/10/71
CHECKED 3/29/71
ENGR APPD 7/7/71
MFG APPD 7/12/71
digilin DIGILIN INCORPORATED 6538 San Fernando Road Glendale, California 91201
SIZE A/T CONVERTER
D | CODE IDENT | 10572 | REV B
SCALE NONE | SHEET 1 OF 1

Figure 6

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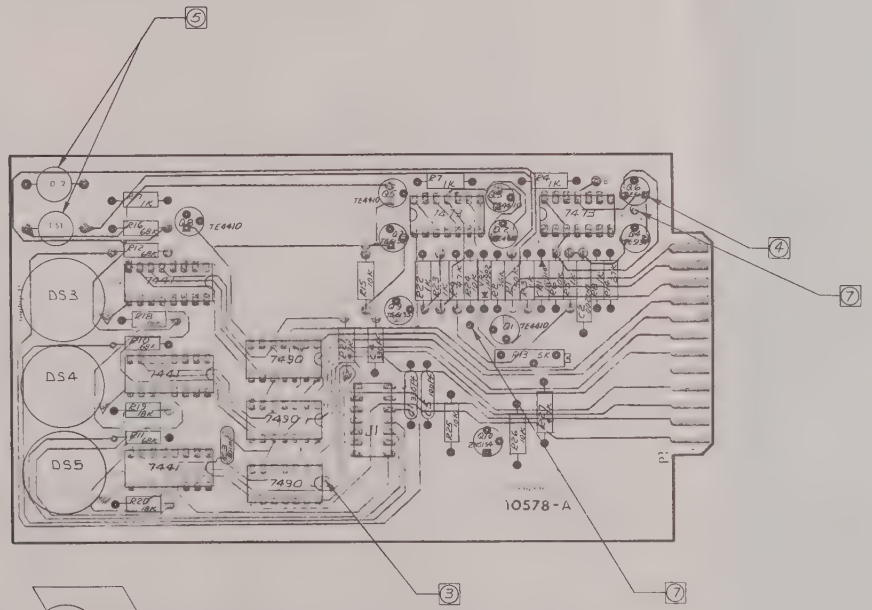
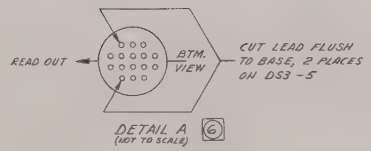
REVISIONS					
ZONE	LTR	ECO	DESCRIPTION	DATE	APPROVED
	%		RELEASE FOR PRODUCTION	8/14/71	
	A	1391	SEE E.C.O.	8/31/71	
	B	1420	SEE E.C.O.	9/24/71	





DETAIL A (NOT TO SCALE) (6)

TAB BLOCK	
DASH ASSY.	STOCK NO.
-1	203001
-2	203002
-3	203003

QTY REQD -3	-2	-1	PART NO	CODE IDENT	DESCRIPTION	STOCK NO.	SPEC	REF DES	ITEM
		1	10668-2		ASSY. DISPLAY BD.	203002			48
		1			INTEGRATED CKT. 7473	170022		U8	47
		1			CAPACITOR 100PF CER	154009		C5	46
		1			CAPACITOR, 330PF CER	154003		C1	45
		1			CAPACITOR, .0082MF 100V. MYLAR	155001		C2	44
		1			POTENTIOMETER 5 K	153001		R13	43
		3			RESISTOR 10K, ¼W, 5%	150007		R6,25,26	42
		1			RESISTOR 2.7K ⅛W, 5%	148007		R14	41
		2			RESISTOR 1K ¼W 5%	150004		R5, 8	40
		1			RESISTOR 4.7 ¼W, 5%	150006		R27	39
									38
		1			DIODE 1N914	172010		CR1	37
		2			TRANSISTOR TE5135	171045		Q4, 6	36
		1			TRANSISTOR 2N5134	171055		Q10	35
		1	10668-1		ASSY. DISPLAY BD.	203001			34
									33
		AR			SLEEVING, CLEAR, TEFLON	125015			32
		AR			BUSS, WIRE	125005			31
		5			TRANSISTOR TE4410	171047		Q1,2,3,5,8	30
		2			TRANSISTOR TE5135	171045		Q7, 9	29
									28
									27
		1			INTEGRATED CKT. 7473	170022		U1	26
		3			INTEGRATED CKT. 7490	170023		U3,5,7	25
		3			INTEGRATED CKT. 7441	170024		U2,4,6	24
									23
									22
		1			ZENER DIODE 1N992	172039		VR1	21
									20
		1			CAPACITOR .01 MF CER	154014		C3	19
		1			CAPACITOR 330 PF CER	154003		C4	18
									17
									16
		2			RESISTOR, 10 K, ¼W, 5%	150007		R15,24	15
		2			4.7K	150006		R9,21	14
		1			56K	150020		R2	13
		1			150K	150057		R1	12
		4			68K	150011		R10,11,18,19	11
		3			18K	150015		R16,17,20	10
		6			RESISTOR, 1K, ¼W, 5%	150004		R3,4,7,12,22,23	9
									8
		1			IC SOCKET, 14 PIN, DIP SOLDER	141028		J1	7
		1			LAMP NEON NE211	160008		DS1	6
		1			LAMP NEON NE2E	160003		DS2	5
		3			INDICATOR TUBE, 2M1000	160001		DS3-5	4
									3
		REF	10670		SCHEMATIC DISPLAY				2
		1	10578A		P.W.B. DISPLAY	147055			1

LIST OF MATERIALS

(7) FOR DASH 3 ASSY. ADD JUMPER BETWEEN POINTS A & C

(6) MODIFICATION TO DS3, 4 & 5 TO BE DONE BEFORE ASSY., (REF. DETAIL "A")

(5) USE ITEM 32 ON DS1 & DS2 BEFORE ASSY.

(4) ■ INDICATES TRANSISTOR EMITTER

(3) ▲ PADS INDICATE FEED THRU, 4 PLACES, USE ITEM 31 SOLDER TO BOTH SIDES OF BOARD

2. MAX LEAD PROTRUSION .050, REF. TOOL 103066, DWG. NO. 10592

1. IDENTIFY PER SPM3-1 WITH DIGILIN STOCK NO AS SHOWN IN TAB BLOCK

NOTES: UNLESS OTHERWISE SPECIFIED

CHECK FOR THESE OUTSTANDING ECO's:
1. 1448
2. 1505

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
XX ± .01 ANGLES 0° 30'
XXX ± .005
MATL
FINISH
NEXT ASSY
USED ON
APPLICATION

SIGNATURES: L.J. GOMEZ; B. Mawhinney; B. Mawhinney

DATE: 8/31/71; 9/24/71

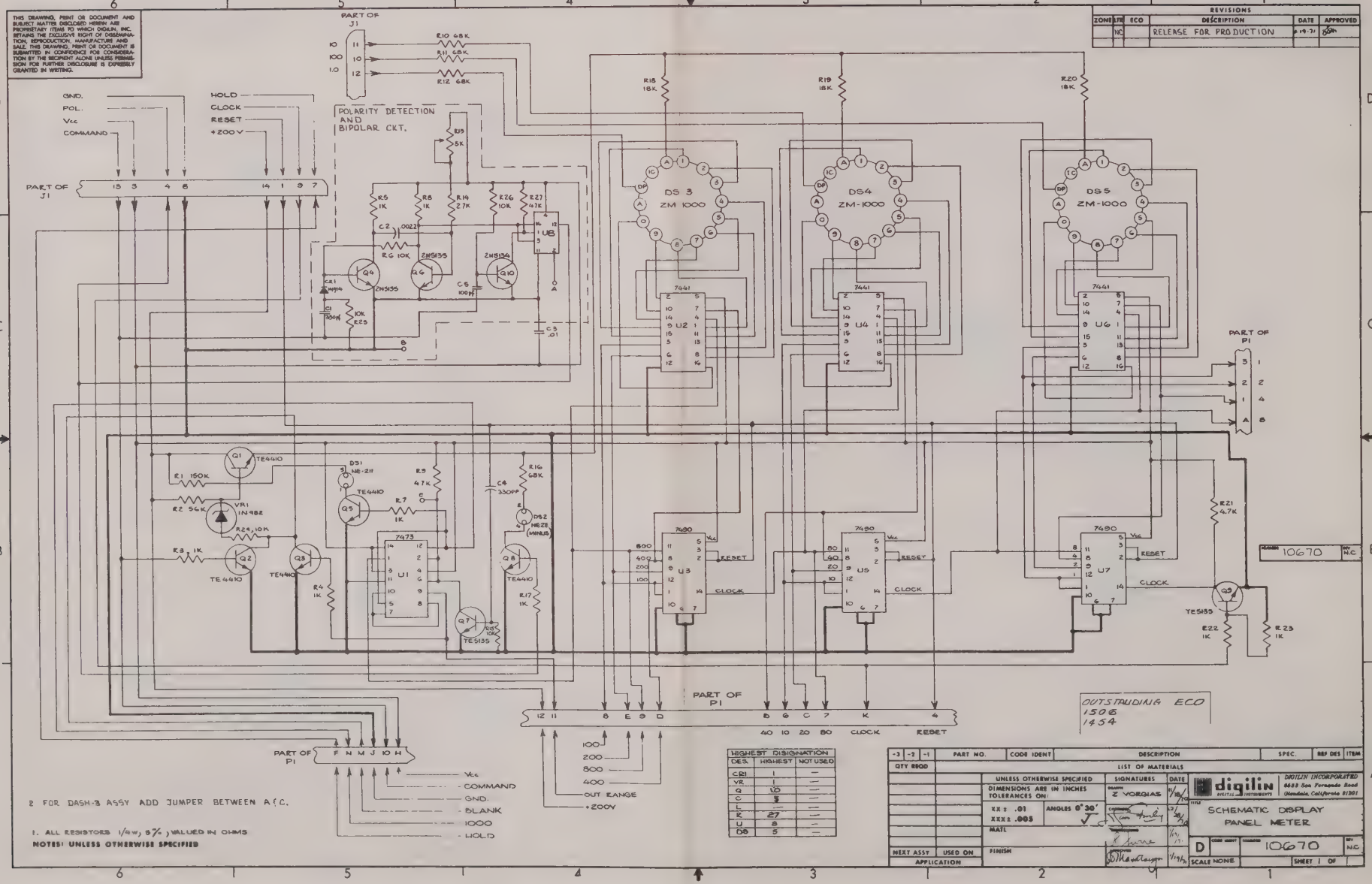
digilin — DIGILIN INCORPORATED, 6533 Van Nuys Boulevard, Van Nuys, California 91401

ASSY. DISPLAY BD.

SIZE D — NUMBER 10668 — REV B

SCALE 2:1 — SHEET 1 OF 1

Figure 7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REVISIONS
ZONE LTR ECO DESCRIPTION DATE APPROVED
NC RELEASE FOR PRODUCTION 6-19-71
PART OF J1
POLARITY DETECTION AND BIPOLAR CKT.
GND.
POL.
Vcc
COMMAND
HOLD
CLOCK
RESET
+200V
DS 3 ZM 1000
DS4 ZM-1000
DS5 ZM-1000
7441
7490
7473
PART OF P1
OUTSTANDING ECO
1506
1454
10670
SCHEMATIC DISPLAY PANEL METER
digilin
DIGILIN INCORPORATED
6633 San Fernando Road
Glendale, California 91201
2 FOR DASH-3 ASSY ADD JUMPER BETWEEN A & C.
1. ALL RESISTORS 1/4W, 5% VALUED IN OHMS
NOTES: UNLESS OTHERWISE SPECIFIED

Figure 8

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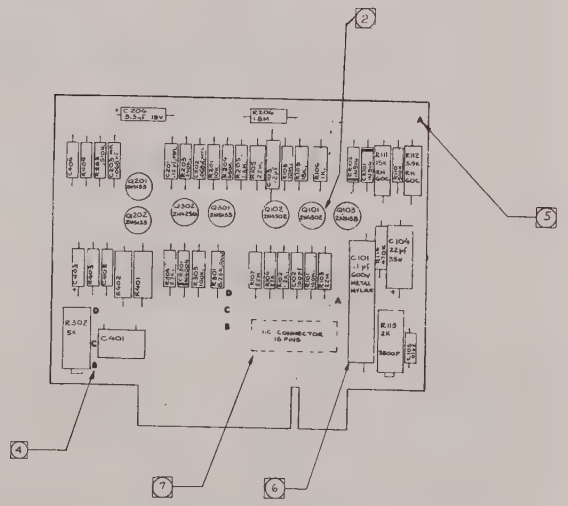
REVISIONS				
LTR	ECO	DESCRIPTION	DATE	APPROVED
	NC	RELEASED FOR PRODUCTION	9/13/71	
	A	SEE E.C.O. 1285, 1324, 1333, 1342 1363	8/5/71	



DASH ASSY	STOCK NO
-1	204001
-2	204002
-3	204003
-4	204004
-6	204005
-10	204010

	BUSS WIRE #298	125005			45
	SLEEVING, BLACK TEFLON 200/2	125001			44
	RESISTOR 9.76K 1%	152009		R402	43
	RESISTOR 987K, 1/4W, 1%	152043		R401	42
10598-5	ASSY. OPTION, PWB.	204005			41
	RESISTOR 270K, 1/4W, 5%	150047		R114	40
	DIODE IN914	172010		CR101 CR102	39
	TRANSISTOR 2N5138	171043		Q103	38
	TRANSISTOR 2N4302	171041		Q101 Q102	37
	CAPACITOR, .01µF, 100V MYLAR	155002		C103 C105	36
	.22µF, 35V METAL	157019		C104	35
	.1 µF, 600V, MYLAR	155015		C101	34
					33
	CAPACITOR, 100 pF	154009		C102	32
	I.C. CONNECTOR 16 PIN W/W	141027		PZ	31
	POTENTIOMETER 2K, 3800P	153021		R113	30
	RESISTOR, 5.9K RN60C	152071		R112	29
	15K, RN60C	152070		R111	28
	510K, 1/4W, 5%	150074		R110	27
	18K,	150015		R109	26
	10M,	150030		R108	25
	22M,	150024		R108, 108 107	24
	1K,	150004		R106	23
	27K,	150043		R104	22
	1.2K,	150036		R102	21
	RESISTOR 100K, 1/8W, 5%	150009		R 101	20
	TRANSISTOR 2N5133	171042		Q 201 Q 202	19
	CAPACITOR, 3.3 µF, 15V	157009		C 204	18
	.068µF, MYLAR	155013		C 202 C 203	17
	CAPACITOR, .12µF, MYLAR	155014		C 201	16
	RESISTOR, 1.5M, 1/4W, 5%	150049		R205	15
	560K,	150073		R204	14
	240K,	150075		R 203	13
	510K,	150074		R 202	12
	10K,	150007		R 201	11
	RESISTOR, 1.8M, 1/4W, 5%	150091		R206	10
	DIODE IN4004	172012		CR 301	9
	TRANSISTOR 2N4250	171044		Q 302	8
	TRANSISTOR 2N5133	171042		Q 301	7
	POTENTIOMETER 5K	153001		R 304	6
	RESISTOR, 8.25K RN60C	152072		R 301	5
	2.7K, 1/4W, 5%	150005		R 304	4
	RESISTOR, 100K, 1/8W, 5%	150009		R 303	3
	SCHEMATIC OPTION BOARD				2
	PWB OPTION BOARD	147051			1
	DESCRIPTION	STOCK NO.	SPEC	REF DES	ITEM

10598 REV A

10	5	4	3	2	1		10594		
							10585		
QTY REQD							PART NO	CODE IDENT	

UNLESS OTHERWISE SPECIFIED	SIGNATURES	DATE	digilin
DIMENSIONS ARE IN INCHES	DRAWN Z VORGIAS	2/3/71	
TOLERANCES ON	CHECKED	2/9/71	ASSY OPTION BOARD
FRACT ±.01 ANGLES 0° 30'	ENGR	2/9/71	
XXX ±.005 ✓	MFG	2/11/71	
MATL	APPROVED	2/11/71	D 10598 REV A
FINISH			SCALE 2:1 SHEET 1 OF 1
NEXT ASSY USED ON APPLICATION			

9 REF. DWG. 10619 FOR DASH 6 THRU 9 ASSY.

8. CKT. SHOWN FOR REF ONLY COMP. ARE NOT MOUNTED ON CKT. SIDE

7 PINS FROM CONNECTOR TO EXTEND .22 ABOVE COMPONENT SIDE OF BOARD

6 C101 WIDEST SIDE FLAT ON BOARD

5 INSTALL JUMPER BETWEEN POINTS A DASH 2, 3 & 5 ASSY

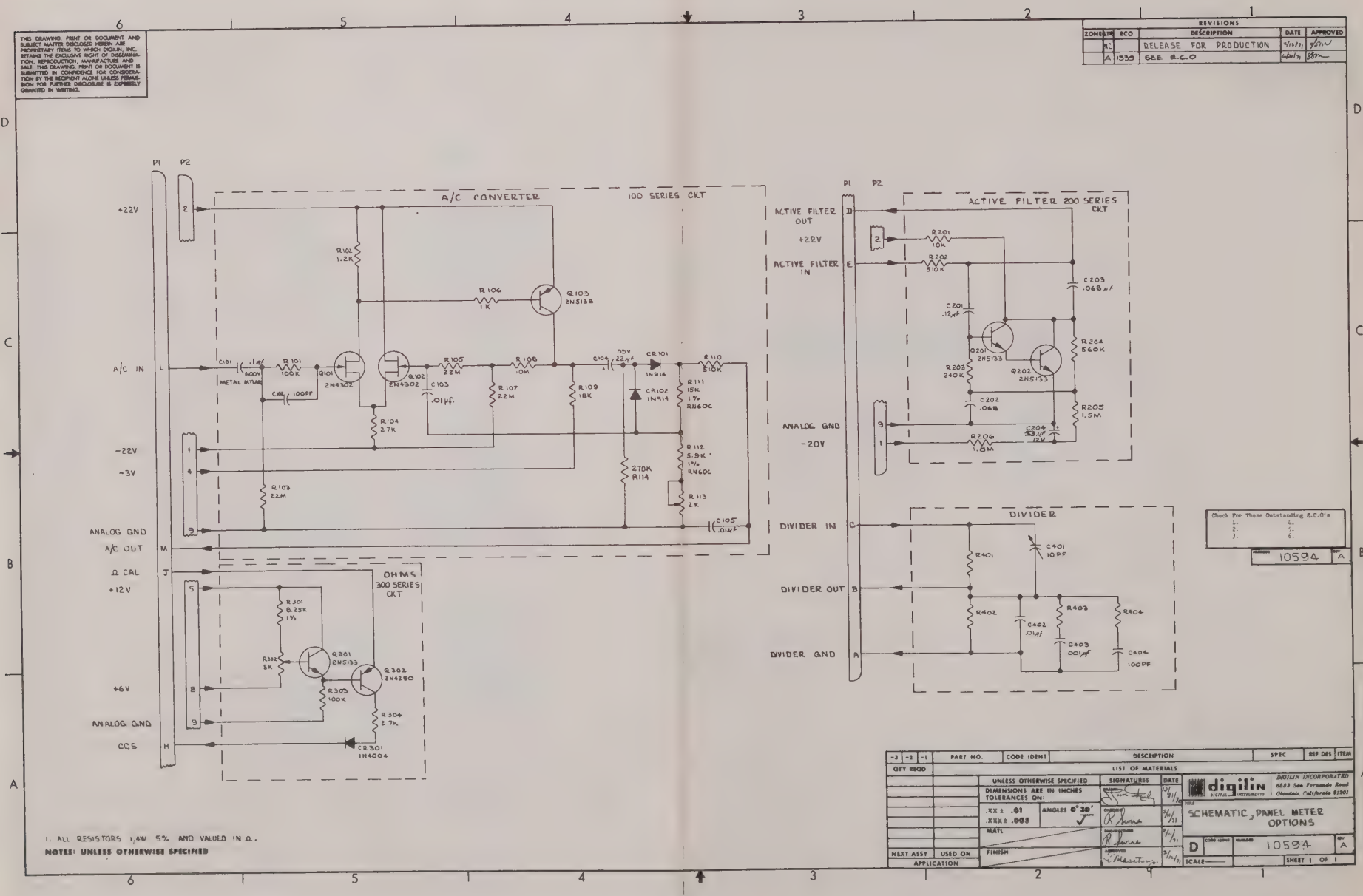
4 INSTALL JUMPERS BETWEEN POINTS B & C & D DASH 1, 3 & 5 ASSYS

3 IDENTIFY PER SPM 7-1 WITH STOCK NO. AS SHOWN IN TABULATION BLOCK

2 SQUARE PAD IS FOR EMITTER OR GATE I.C. CONNECTOR ON CIRCUIT SIDE

NOTES: UNLESS OTHERWISE SPECIFIED

Figure 9



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REVISIONS				
ZONE	LTR	ECO	DESCRIPTION	DATE	APPROVED
	NC		RELEASE FOR PRODUCTION	9/27/71	
	A	1330	SEE E.C.O	10/1/71	

Check For These Outstanding E.C.O's
1. 4.
2. 5.
3. 6.

10594 A

1. ALL RESISTORS 1/4W 5% AND VALUED IN Ω.

NOTES: UNLESS OTHERWISE SPECIFIED

-3	-2	-1	PART NO.	CODE IDENT	DESCRIPTION	SPEC	REF DES	ITEM
QTY REQD			LIST OF MATERIALS					

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON:
.XX ± .01 ANGLES 0° 30'
.XXX ± .003
MATL
FINISH
NEXT ASSY USED ON
APPLICATION

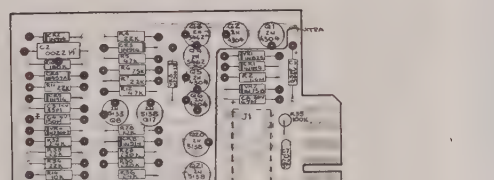
SIGNATURES DATE
DRAWN 10/1/71
CHECKED 3/14/72
ENGINEERING 3/1/72
APPROVED 3/14/72

digilin DIGITAL INSTRUMENTS
DIGILIN INCORPORATED 6833 San Fernando Road Glendale, California 91201

TITLE SCHEMATIC, PANEL METER OPTIONS

SIZE D CODE IDENT 10594 REV A
SCALE —— SHEET 1 OF 1

Figure 10



TAB BLOCK

DASH ASSY	STOCK NO.
-1	202010
-2	202011
-3	202018

6 SEE 10623 SCHEMATIC A/T CONV. BIPOLAR, FOR REF.

5 INSTALL JUMPERS AS SHOWN ON DASH 2 AND 3 ASSY ONLY, 3 PLACES.

4 IDENTIFY PER SPM 7-1 AND STOCK NO AS SHOWN IN TAB BLOCK

3 P2 AND J1 MOUNTED ON C.K.T SIDE OF BOARD

2 ◆ INDICATES TRANSISTOR EMITTER, AND GATE ON Q1 THRU Q7

1 CR1,2,3,5,6,7,8,9 ARE ITEM 31

NOTES: UNLESS OTHERWISE SPECIFIED

-5	-4	-3	-2	-1	PART NO	CODE IDENT	DESCRIPTION	STOCK NO	SPEC	REF DES	ITEM
											55
											54
											53
							I.C. CONNECTOR 16 PIN D.S.	14.02.9		J1	52
											51
				1	10669-1		ASSY A/T CONV.	202010			50
				1	10669-1		ASSY A/T CONV.	202010			49
				A/R			TEFLON SLEEVING	125015			48
				A/R			⏚ BUSS WIRE	125005			47
				1			I.C. SOCKET, 16 PIN, WIRE WRAP	141021		P2	46
				1			CAPACITOR 47μF, 20V	160120		C8	45
				1			.47μF, 50V	164025		C7	44
				1			3.3μF, 15V	157009		C6	43
				1			1.1μF, 100V, MET/POL	157028		C5	42
				1			150pF, 4V	1570028		C4	41
				1			33pF, 1KV	154026		C3	40
				1			.0022μF, 100V	155001		C2	39
				1			CAPACITOR 3.3pF, 500V	154029		C1	38
				1			DIODE MZ500-7	172002		VR4	37
				1			MZ500-22	172013		VR3	36
				1			IN758	172037		VR2	35
				1			IN826	172028		VR1	34
				1			IN459A	172009		CR4	33
				8			DIODE IN914	172010		(1)	32
				2			TRANSISTOR 2N5134	171055		Q13,14	31
				2			TES135	171045		Q16,18	30
				1			2N4250	171044		Q12	29
				5			2N5138	171043		Q5,10,17 ECL#1	28
				1			2N4302	171041		Q7	27
				4			2N5133	171042		Q8,15,11 13,	26
				1			2N5462	171004		Q4	25
				1			2N4304	171039		Q2	24
				1	10369		2N5462 SELECT	171028	RED	Q3	23
				3	10569		TRANSISTOR 2N4304 SELECT	171062	SILVER	Q1,6,9	22
				1			RESISTOR 26.5K, RC60, 1%	152047		R1	21
				1			150K, 1/4W, 5%	150057		R26	20
				1			470Ω	150003		R22	19
				1			2.4K	150067		R32	18
				3			220K	150014		R29,30,31	17
				1			330Ω	150002		R20	16
				2			100K	150009		R17,35	15
				6			10K	150007		R13,14,18 19,20,28	14
				1			24K	150088		R24	13
				4			1K	150004		R5,15 23,27	12
				1			2.2K	150001		R7	11
				1			7.5K	150095		R6	10
				1			180K	150086		R10	9
				1			5.6K	150041		R16	8
				1			47K	150012		R8	7
				5			22K	150008		R4,11,21 25,29	6
				1			2.7K	150005		R9	5
				3			4.7K	150006		R3,12,16	4
				1			RESISTOR 1.6M, 1/4W, 5%	150087		R2	3
				1	10623		P.W.B BIPOLAR A/T CONV.	147056			2
				Q'TY REQD	PART NO	CODE IDENT	DESCRIPTION	STOCK NO	SPEC	REF DES	ITEM

LIST OF MATERIALS (CONT'D)

Check For These Outstanding E.C.O's
1. 4.
2. 5.
3. 6.

10669 C

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
XX ± .01 ANGLES ± 0°30'
XXX ± .005
MAT
FINISH

	SIGNATURES	DATE
DRAWN	Z. VORSIAS	2-21-71
CHECKED	J.J. GOMEZ	2/24/71
ENGINEER		3/24/71
PROJECT ENGINEER		4/14/71

digilin

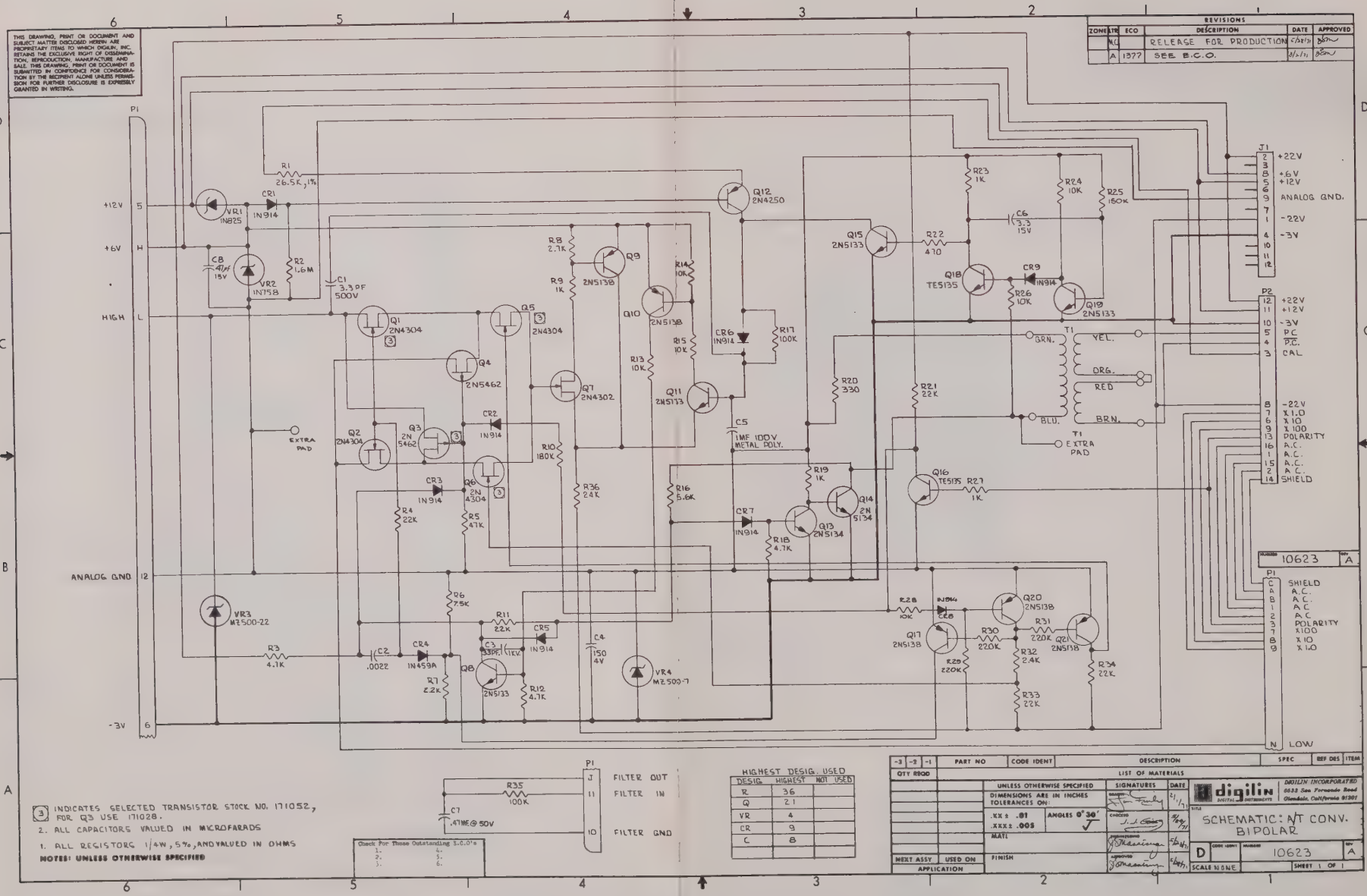
ASSY. A/T CONV.

SIZE D | 10669 | REV C

SCALE 1:1 | SHEET 1 OF 1

NEXT ASSY | USED ON
APPLICATION

Figure 11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REVISIONS
ZONE LTR ECO DESCRIPTION DATE APPROVED
N/C RELEASE FOR PRODUCTION 1/21/71
A 1377 SEE E.C.O. 2/1/71
P1
+12V 5
+6V H
HIGH L
ANALOG GND 12
-3V 6
R1 26.5K, 1%
CR1 1N914
VR1 1N825
VR2 1N758
CB .47µF 15V
R2 1.6M
C1 3.3PF 500V
Q1 2N4304
Q2 2N4304
Q3 2N5462
Q4 2N5462
Q5 2N4304
Q6 2N4304
Q7 2N4302
CR2 1N914
CR3 1N914
EXTRA PAD
R4 22K
R5 47K
R6 7.5K
R10 180K
R36 24K
R3 4.1K
C2 .0022
CR4 1N459A
R7 2.2K
Q8 2N5133
R11 22K
C3 33PF 1KV
CR5 1N914
R12 4.7K
C4 150 4V
VR3 MZ500-22
VR4 MZ500-7
R8 2.7K
R9 1K
Q9 2N5138
Q10 2N5138
Q11 2N5173
R14 10K
R15 10K
R13 10K
CR6 1N914
R17 100K
C5 1MF 100V METAL POLY.
Q12 2N4250
R16 5.6K
CR7 1N914
R18 4.7K
R19 1K
Q13 2N5134
Q14 2N 5134
R20 330
R21 22K
Q15 2N5133
R22 470
R23 1K
R24 10K
R25 150K
C6 3.3 15V
Q18 TE5135
CR9 1N914
R26 10K
Q19 2N5133
T1
GRN.
YEL.
ORG.
RED
BLU.
BRN.
EXTRA PAD
Q16 TE5135
R27 1K
R28 10K
CR8 1N914
Q20 2N5138
Q17 2N5138
R30 220K
R31 220K
Q21 2N5138
R29 220K
R32 2.4K
R33 22K
R34 22K
J1
2 +22V
3 +6V
8 +12V
5 ANALOG GND.
6
9
7 -22V
1 -3V
4
10
11
12
P2
12 +22V
11 +12V
10 -3V
5 P.C.
4 P.C.
3 CAL
8 -22V
7 X1.0
6 X10
9 X100
13 POLARITY
16 A.C.
1 A.C.
15 A.C.
2 A.C.
14 SHIELD
10623 A
P1
C SHIELD
A A.C.
B A.C.
1 A.C.
2 POLARITY
3 X100
7 X10
8 X1.0
9
N LOW
3 INDICATES SELECTED TRANSISTOR STOCK NO. 171052, FOR Q3 USE 171028.
2. ALL CAPACITORS VALUED IN MICROFARADS
1. ALL RESISTORS 1/4W, 5%, AND VALUED IN OHMS
NOTES: UNLESS OTHERWISE SPECIFIED
P1
J FILTER OUT
11 FILTER IN
10 FILTER GND
R35 100K
C7 .47MF@ 50V
Check For These Outstanding E.C.O.'s
1. 4.
2. 5.
3. 6.
HIGHEST DESIG. USED
DESIG HIGHEST NOT USED
R 36
Q 21
VR 4
CR 9
C 8
-3 -2 -1 PART NO CODE IDENT DESCRIPTION SPEC REF DES ITEM
QTY REQD
LIST OF MATERIALS
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON:
.XX ± .01 ANGLES 0° 30'
.XXX ± .005
MAT'L
FINISH
NEXT ASSY USED ON
APPLICATION
SIGNATURES DATE
DRAWN 1/19/71
CHECKED 1/19/71
ENGINEERING 1/19/71
APPROVED 1/19/71
digilin DIGILIN INCORPORATED 6633 San Fernando Road Glendale, California 91201
TITLE SCHEMATIC: NT CONV. BIPOLAR
D 10623 A
SCALE NONE SHEET 1 OF 1

Figure 12

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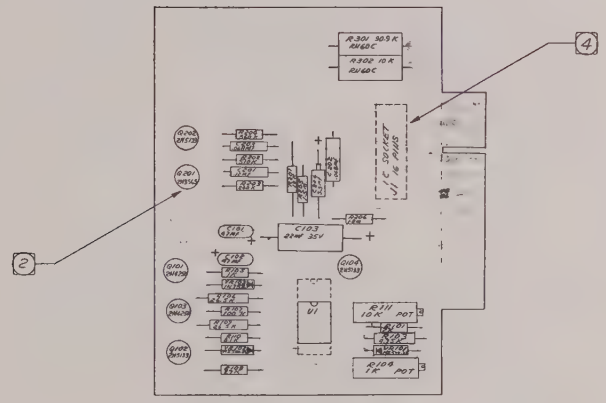
REVISIONS					
ZONE	LTR	ECO	DESCRIPTION	DATE	APPROVED
	A		RELEASED FOR PRODUCTION	11/3/71	



DASH ASSY	STOCK NO
-6	204006
-7	204007
-8	204008
-9	204009

QTY REQD					PART NO	CODE IDENT	DESCRIPTION	STOCK NO	SPEC	REF DES	ITEM
					10619-7		-7 RATIOMETER OPTION	204007			38
					10619-6		-6 RATIOMETER OPTION	204006			37
							RESISTOR 5.76 K, RN60C, 1%	152077		R103	36
							RESISTOR 10.0K RN60C, 1%	152078		R302	35
							90.9K RN60C, 1%	152079		R301	34
				1			4.75K, RN60C, 1%	152076		R103	33
				2			26.5K, ½W, 1%	152047		R108 R109	32
				1			1.5M ¼W, 5%	150049		R205	31
				1			1.8M	150091		R206	30
				1			27 K	150043		R108	29
				1			240 K	150075		R203	28
				1			560 K	150073		R204	27
				1			510 K	150074		R202	26
				1			100 K	150009		R107	25
				1			10 K	150007		R201	24
				1			1 K	150004		R105	23
				1			RESISTOR 2 K, ¼W, 5%	150060		R101	22
				1			RESISTOR 5.1K, ¼W, 5%	150094		R110	21
				1			POTENTIOMETER 1K CERMENT	153032		R104	20
				1			POTENTIOMETER 10K	153027		R111	19
											18
											17
				2			CAPACITOR 47MF, 20V, TANT	157001		C101 C102	16
				1			22MF, 35V, TANT	157019		C103	15
								10619			B
				1			3.3MF, 15V, TANT	157009		C204	14
				2			.068MF, 100V, METALLAR	155013		C205 C203	13
				1			CAPACITOR, .12MF, 100V METALLAR	155014		C201	12
											11
											10
				1			ZENER DIODE 1N752	172008		VR101	9
				2			ZENER DIODE 1N2500-22	172013		VR102 VR104	8
				1			TRANSISTOR 2N3565	171058		Q201	7
				2			TRANSISTOR 2N4250	171044		Q101 Q103 Q104	6
7				1	2		TRANSISTOR 2N5133	171042		Q102	5
				1			INTEGRATED CKT 74XC	170026		U1	4
				1			I.C. SOCKET	141027		J1	3
REF DES	REF DES	REF DES	REF DES		10617		SCHEMATIC: RATIOMETER				2
				1	10618		P.W.B. RATIOMETER	147052			1

LIST OF MATERIALS

UNLESS OTHERWISE SPECIFIED	SIGNATURES	DATE
DIMENSIONS ARE IN INCHES TOLERANCES ON	DRAWN J.L. Cook	11/3/71
XX ± .01 ANGLES 0° 30'	CHECKED Jim Fahy	11/3/71
XXX ± .005	ENG APPROVAL M.E. Pruett	11/3/71
MATL	MFG APPROVED [illegible]	11/3/71
FINISH		
NEXT ASSY	USED ON	
APPLICATION		

digilin — 1811 Fox Lane, San Fernando, California 91301

ASSY. RATIOMETER BD

SIZE	DWG NO	REV
D	10619	A/C

SCALE 2:1 SHEET 1 OF 1

7. Q202 ADDED ON DASH-7 ASSY. ONLY.
6. TO BE USED AS REPLACEMENT, IF NEEDED IN TEST
5. CIRCUIT SHOWN FOR REF. ONLY COMP. ARE NOT MOUNTED ON CIRCUIT SIDE
4. PINS FROM CONNECTOR TO EXTEND .22 ABOVE COMPONENT SIDE OF BOARD
3. IDENTIFY PER SPMT-1 WITH STOCK NO. AS SHOWN IN TABULATION BLOCK
2. SQUARE PAD IS FOR EMITTER OR GATE
1. I.C. CONNECTOR ON CIRCUIT SIDE

NOTES: UNLESS OTHERWISE SPECIFIED

Figure 13

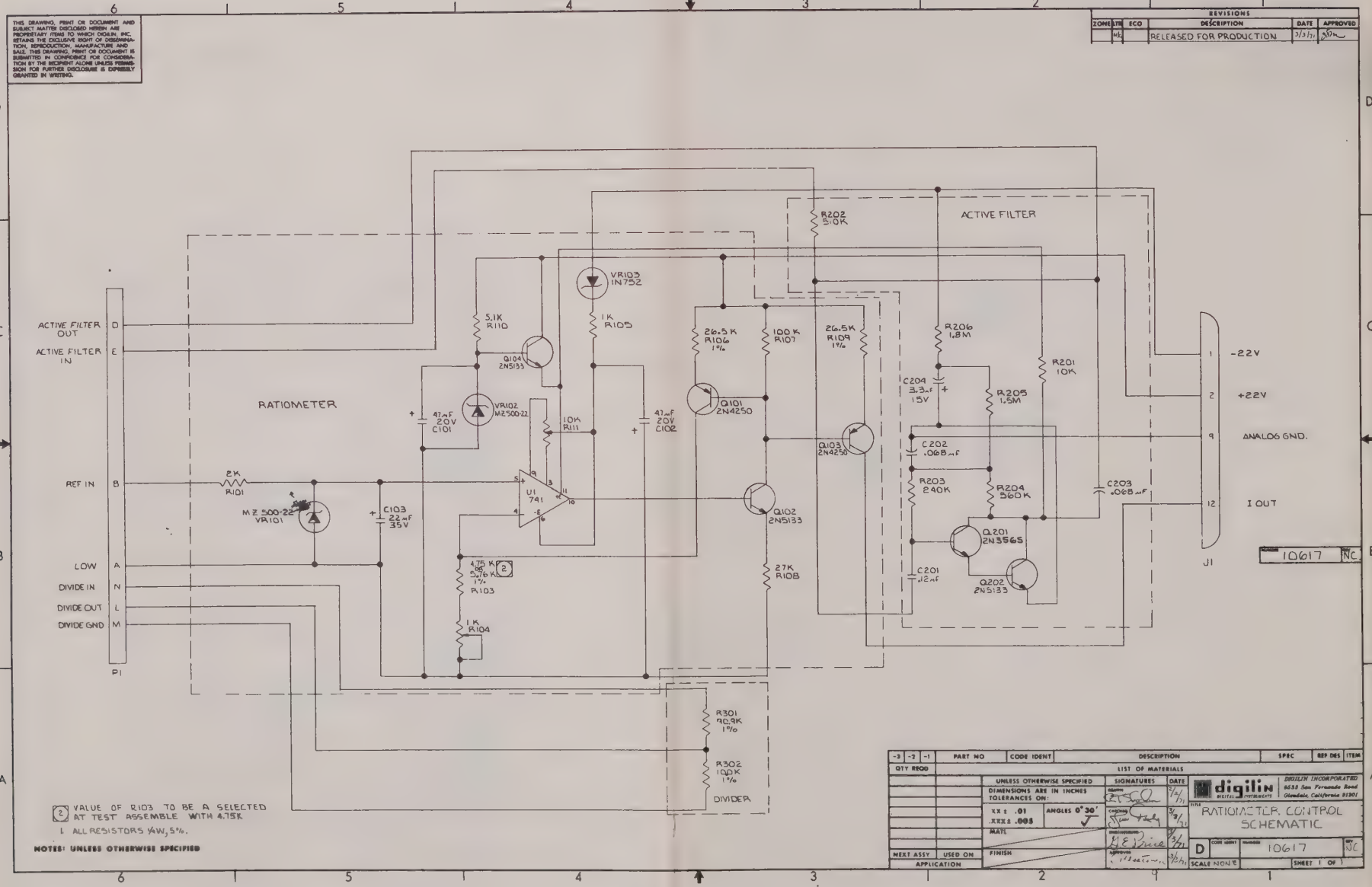

ACTIVE FILTER OUT
ACTIVE FILTER IN
REF IN
LOW
DIVIDE IN
DIVIDE OUT
DIVIDE GND
P1
RATIOMETER
R101 2K
VR101 MZ500-22
C103 22mF 35V
VR102 MZ500-22
C101 47mF 20V
R110 5.1K
R105 1K
VR103 1N752
C102 47mF 20V
R111 10K
Q104 2N5133
U1 741
R103 4.75K 5.76K 1%
R104 1K
R108 27K
Q102 2N5133
R106 26.5K 1%
R107 100K
Q101 2N4250
R109 26.5K 1%
Q103 2N4250
R202 5.0K
ACTIVE FILTER
R206 1.8M
R201 10K
C204 3.3mF 15V
R205 1.5M
C202 .068mF
R203 240K
R204 360K
C203 .068mF
Q201 2N3565
Q202 2N5133
C201 .12mF
R301 90.9K 1%
R302 100K 1%
DIVIDER
J1
1 -22V
2 +22V
9 ANALOG GND.
12 I OUT
10617 NC
2 VALUE OF R103 TO BE A SELECTED AT TEST ASSEMBLE WITH 4.75K
1. ALL RESISTORS ¼W, 5%.
NOTES: UNLESS OTHERWISE SPECIFIED
REVISIONS
ZONE | LTR | ECO | DESCRIPTION | DATE | APPROVED
RELEASED FOR PRODUCTION 3/31/71
LIST OF MATERIALS
-3 | -2 | -1 | PART NO | CODE IDENT | DESCRIPTION | SPEC | REF DES | ITEM
QTY REQD
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON:
xx ± .01
.xxx ± .005
ANGLES 0° 30'
MATL
FINISH
NEXT ASSY | USED ON
APPLICATION
SIGNATURES | DATE
3/1/71
3/9/71
3/5/71
3/5/71
digilin DIGITAL SYSTEMS
DIGILIN INCORPORATED
6633 San Fernando Road
Glendale, California 91201
TITLE RATIOMETER CONTROL SCHEMATIC
D 10617 REV NC
SCALE NONE SHEET 1 OF 1

Figure 14

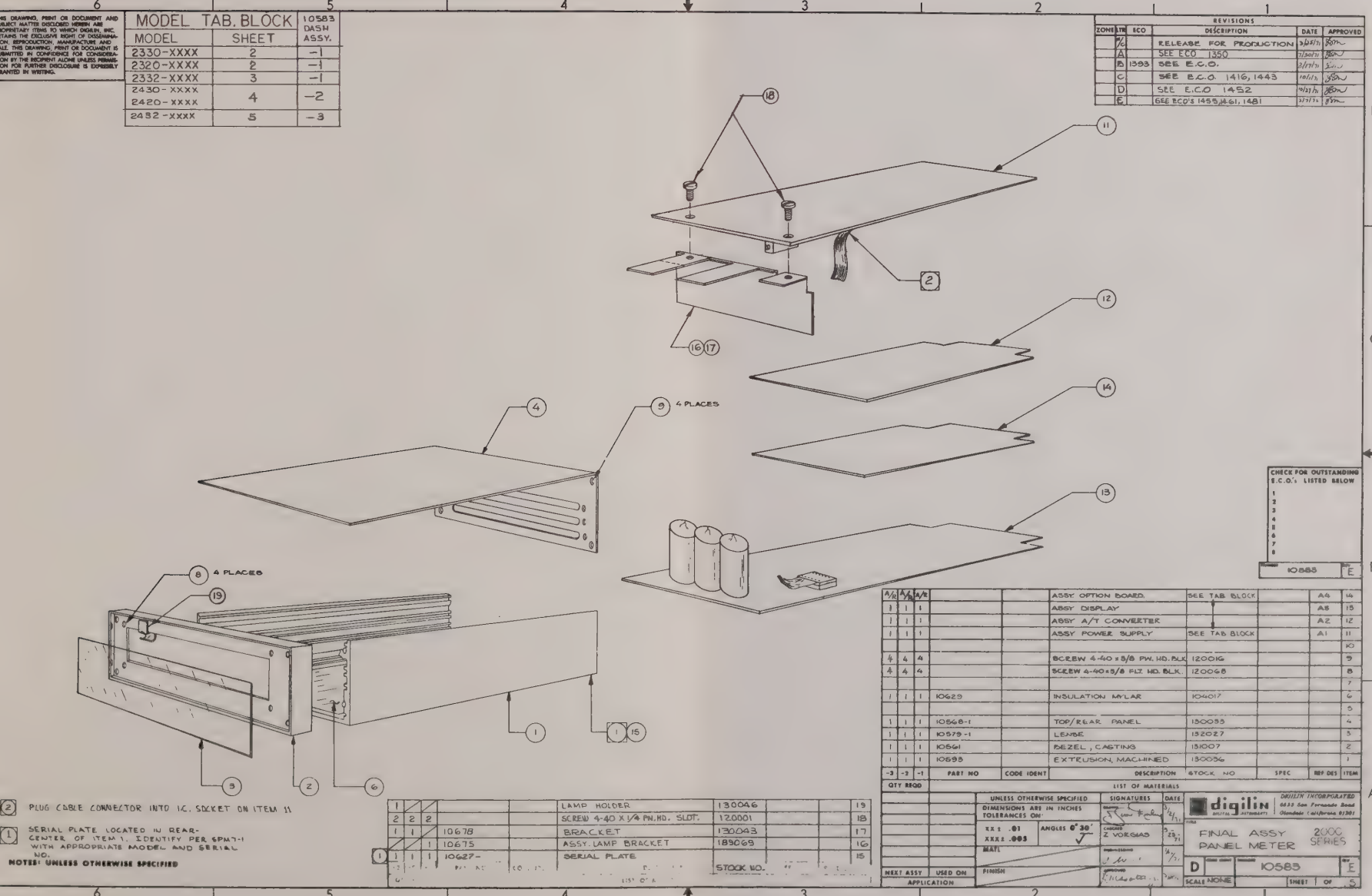

MODEL TAB. BLOCK
10583 DASH ASSY.
MODEL | SHEET
2330-XXXX | 2 | -1
2320-XXXX | 2 | -1
2332-XXXX | 3 | -1
2430-XXXX, 2420-XXXX | 4 | -2
2432-XXXX | 5 | -3
REVISIONS
ZONE | LTR | ECO | DESCRIPTION | DATE | APPROVED
P/C | RELEASE FOR PRODUCTION | 3/22/71
A | SEE ECO 1350 | 7/30/71
B | 1393 | SEE E.C.O. | 2/17/71
C | SEE E.C.O. 1416, 1443 | 10/1/71
D | SEE E.C.O 1452 | 9/23/71
E | SEE ECO'S 1455, 1461, 1481 | 12/7/71
CHECK FOR OUTSTANDING E.C.O.'s LISTED BELOW
10583 REV E
4 PLACES
4 PLACES
PLUG CABLE CONNECTOR INTO I.C. SOCKET ON ITEM 11
SERIAL PLATE LOCATED IN REAR-CENTER OF ITEM 1. IDENTIFY PER SPM71-1 WITH APPROPRIATE MODEL AND SERIAL NO.
NOTES: UNLESS OTHERWISE SPECIFIED
ASSY OPTION BOARD | SEE TAB. BLOCK | A4 | 14
ASSY DISPLAY | A5 | 13
ASSY A/T CONVERTER | A2 | 12
ASSY POWER SUPPLY | SEE TAB. BLOCK | A1 | 11
10
4 4 4 | SCREW 4-40 x 3/8 PN. HD. BLK. | 12001G | 9
4 4 4 | SCREW 4-40 x 5/8 FLT. HD. BLK. | 12006B | 8
7
1 1 1 10629 | INSULATION MYLAR | 104017 | 6
5
1 1 1 10568-1 | TOP/REAR PANEL | 130093 | 4
1 1 1 10579-1 | LENSE | 132027 | 3
1 1 1 10561 | BEZEL, CASTING | 131007 | 2
1 1 1 10593 | EXTRUSION, MACHINED | 130096 | 1
-3 -2 -1 | PART NO | CODE IDENT | DESCRIPTION | STOCK NO | SPEC | REF DES | ITEM
QTY REQD
LIST OF MATERIALS
2 2 2 | SCREW 4-40 X 1/4 PN.HD. SLOT. | 120001 | 18
1 1 10678 | BRACKET | 130043 | 17
1 1 10675 | ASSY. LAMP BRACKET | 189069 | 16
1 1 1 10627- | SERIAL PLATE | 15
LAMP HOLDER | 130046 | 19
STOCK NO.
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON:
XX ± .01
XXX ± .005
ANGLES 0° 30'
SIGNATURES
DATE
Z VORGIAS
MATL
FINISH
NEXT ASSY
USED ON
APPLICATION
digilin
DIGILIN INCORPORATED
5833 San Fernando Road
Glendale California 91201
FINAL ASSY
PANEL METER
2000 SERIES
D
10583
REV E
SCALE NONE
SHEET 1 OF 5

Figure 17

WARRANTY AND REPAIR PROCEDURE

1. If failure occurs, call factory.

2. State serial number(s) of meter(s) to be returned.

   A. If meter shipped within last 90 days, no charge warranty.* (FOB Factory)

   B. If meter shipped within last 90 days to one year, warranty but $25.00 recalibration charge. (FOB Factory)

   C. If meter shipped over one year ago, repair charge for all labor and material.

3. "Return Authorization Number(s)" will be issued based on above categories.

4. Ship meter(s) to factory with "Return Authorization Number(s)" clearly shown on your packing slip.

5. When contacting factory regarding returned meters, please refer to appropriate "Return Authorization Number".

Note: To avoid unnecessary delay, contact factory before sending meters back as all meters received without "Return Authorization Number(s)" will either be held pending customer contact or may be returned to customer, at Digilin's option.

Collect or COD shipments will not be accepted.

SHIPPING DAMAGE

PLEASE INSPECT YOUR DIGILIN PANEL METER UPON RECEIPT FOR EVIDENCE OF SHIPPING DAMAGE. IF DAMAGE IS EVIDENT, OR THE INSTRUMENT FAILS TO OPERATE PROPERLY, A CLAIM MUST BE FILED WITH THE CARRIER, PROMPTLY. INSTRUCT THE CARRIER TO FORWARD A COPY OF THE CLAIM TO DIGILIN.

MP MASTER
MA26186